GCE A level

1204/01

S16-1204-01

GEOGRAPHY – G4
Sustainability

A.M. THURSDAY, 16 June 2016

1 hour 45 minutes

ADDITIONAL MATERIALS

In addition to this question paper, you will need the Resource Folder and **one** pink WJEC 20 page answer book, which has been specifically designed for this examination. No other style of answer book should be used. Should you run out of space, use a standard 4 page continuation book.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Answer **all** questions.

Write your answers in the separate answer book provided, following the instructions on the front of the answer book.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answers.

You are reminded that this paper is synoptic and so will assess your ability to draw on your understanding of the connections between the different aspects of the subject represented in the geography specification.

Even where not specifically asked for, you should support your answer with examples and/or case studies.

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Answer **all** *questions.*

SECTION A

In this section you may use information from the ***Resource Folder*** *and your own research.*

0 1 Describe variations in the growth rates of cities throughout the world. [10]
(approximately 13 minutes)

0 2 Outline problems associated with the supply of energy. [10]
(approximately 13 minutes)

0 3 Outline the advantages of **two** alternative sources of energy. [10]
(approximately 13 minutes)

0 4 'The growth of cities inevitably causes an increase in energy use.'
Assess how far this is true and its implications for sustainability. [25]
(approximately 33 minutes)

SECTION B

In this section you may use information from any of your studies for AS and A2 Geography as well as from the ***Resource Folder*** *and your own research.*

0 5 Describe ways in which physical factors can limit food production.
How far can technological developments overcome these limitations and ensure a sustainable supply of food? [25]
(approximately 33 minutes)

END OF PAPER

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GCE A level

1204/01-A

S16-1204-01A

GEOGRAPHY – G4
Sustainability

A.M. THURSDAY, 16 June 2016

Examination copy

To be given out at the start of the examination.

The pre-release copy must not be used.

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RESOURCE FOLDER

ADVICE TO CANDIDATES

In this synoptic exercise you will be assessed on your ability to **synthesise knowledge and understanding and skills** derived from your A level course.

You are reminded that assessment will take into account the quality of written communication used in your answers.

The main focus of the material in this Resource Folder is related to cities, their growth, their use of energy and on supplies of energy that can be used in cities.

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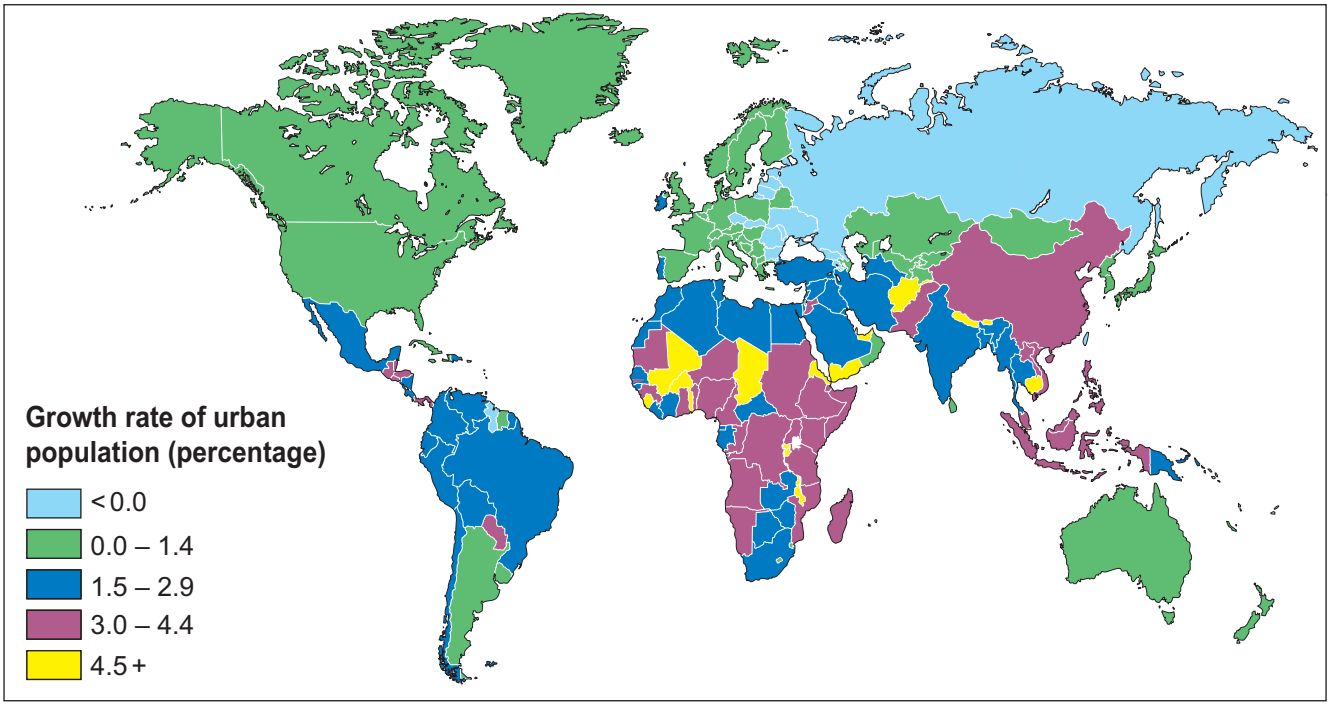
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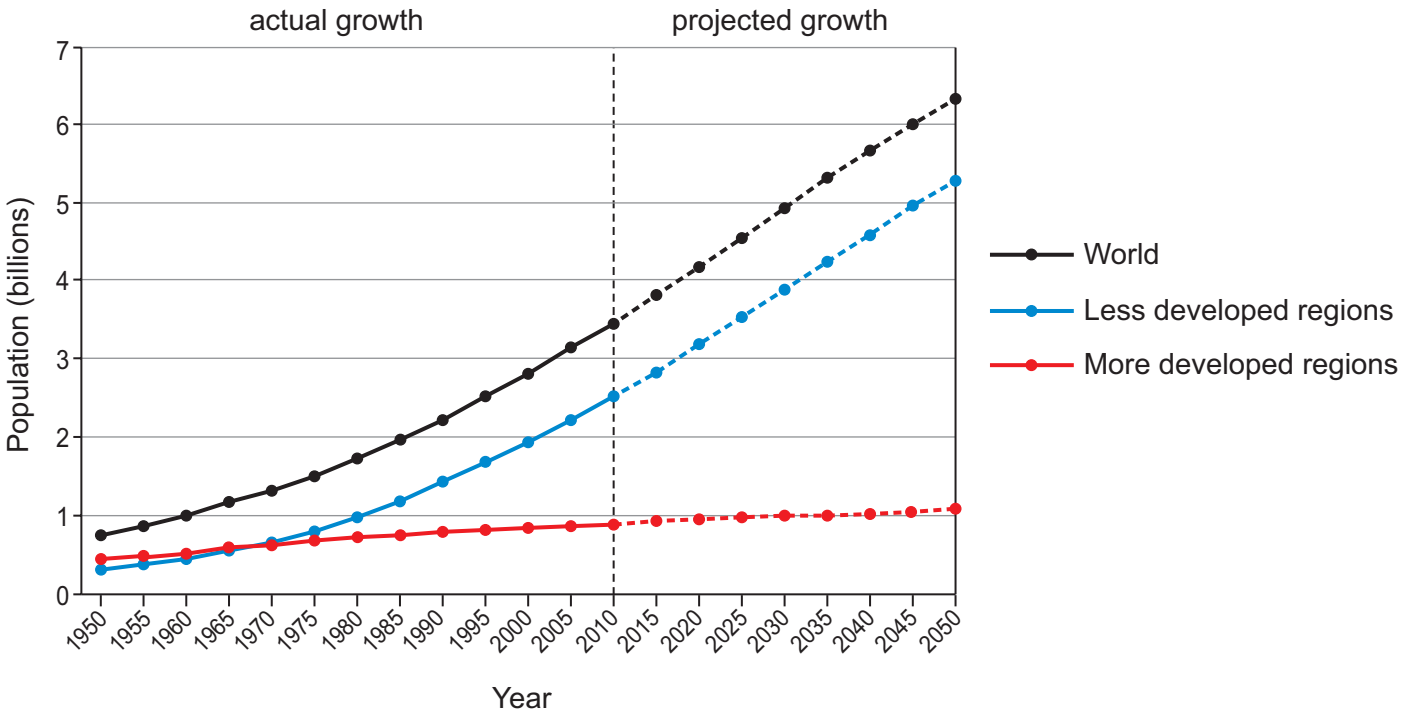
CHANGING CITIES

Figure 1: Average annual growth of urban population by country, 2000–2005



Source: iph-partnership.org

Figure 2: Actual and projected growth of urban population in more developed regions, less developed regions and the world



Source: iph-partnership.org

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Figure 3: Selected fastest growing cities in the world with populations over 10 million in 2007

City	Population 1975 (millions)	Population 2007 (millions)	Annual percentage change 1975–2007
Mexico City	10.7	19.0	1.8
Mumbai	7.1	19.0	3.1
Sao Paulo	9.6	18.8	2.1
Delhi	4.4	15.9	4.0
Shanghai	7.3	15.0	2.2
Dhaka	2.2	13.5	5.6
Karachi	4.0	12.1	3.5
Beijing	6.0	11.1	1.9
Manila	5.0	11.1	2.5
Istanbul	3.6	10.1	3.2

Source: adapted from iph-partnership.org

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Figure 4: Selected cities with low or negative growth rates

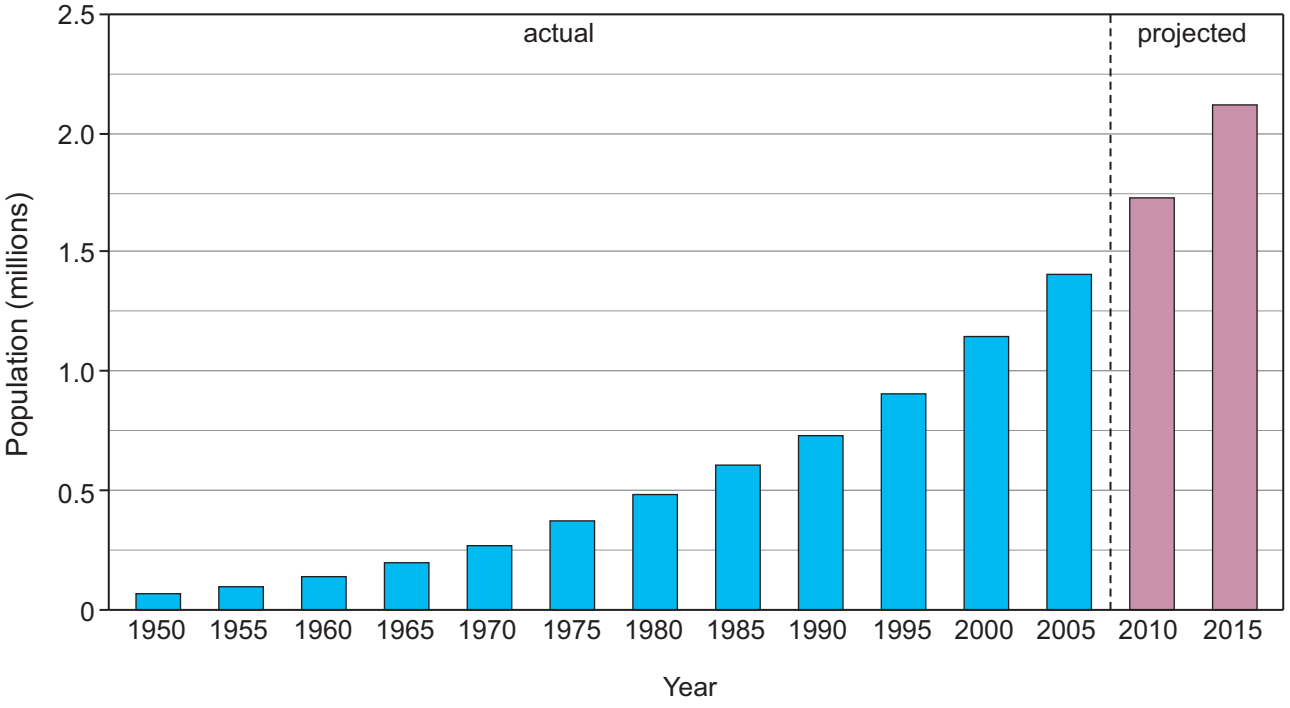
City	Population 1975 (millions)	Population 2010 (millions)	Annual percentage change 1975–2010
Tokyo	19.8	26.4	0.9
New York	15.9	17.2	0.2
Osaka	9.8	11.0	0.4
Paris	8.9	9.7	0.3
London	8.6	7.6	–0.3
Moscow	7.6	9.3	0.6
Rome	2.9	2.7	–0.2
Budapest	2.0	1.8	–0.3
Pittsburgh	1.8	1.8	0.0
Riga	0.9	0.8	–0.3

Sources: adapted from www.demographia.com

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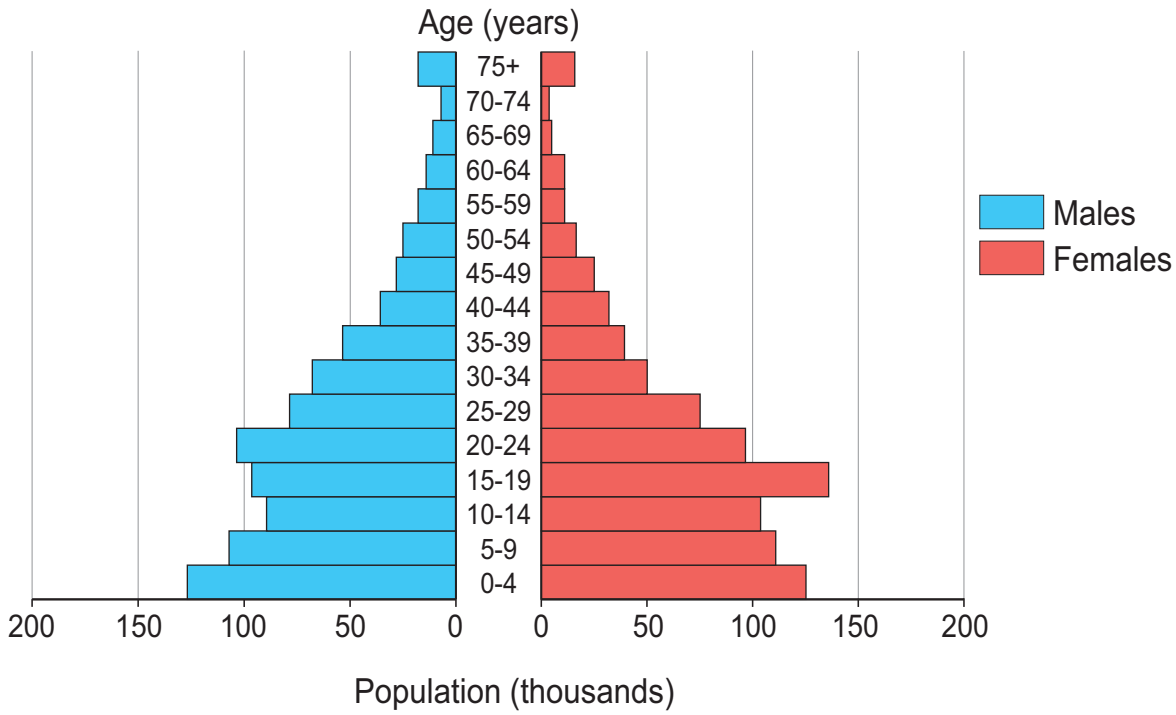
Turn over.

Figure 5: Population change in Bamako, Mali



Source: books.mongabay.com

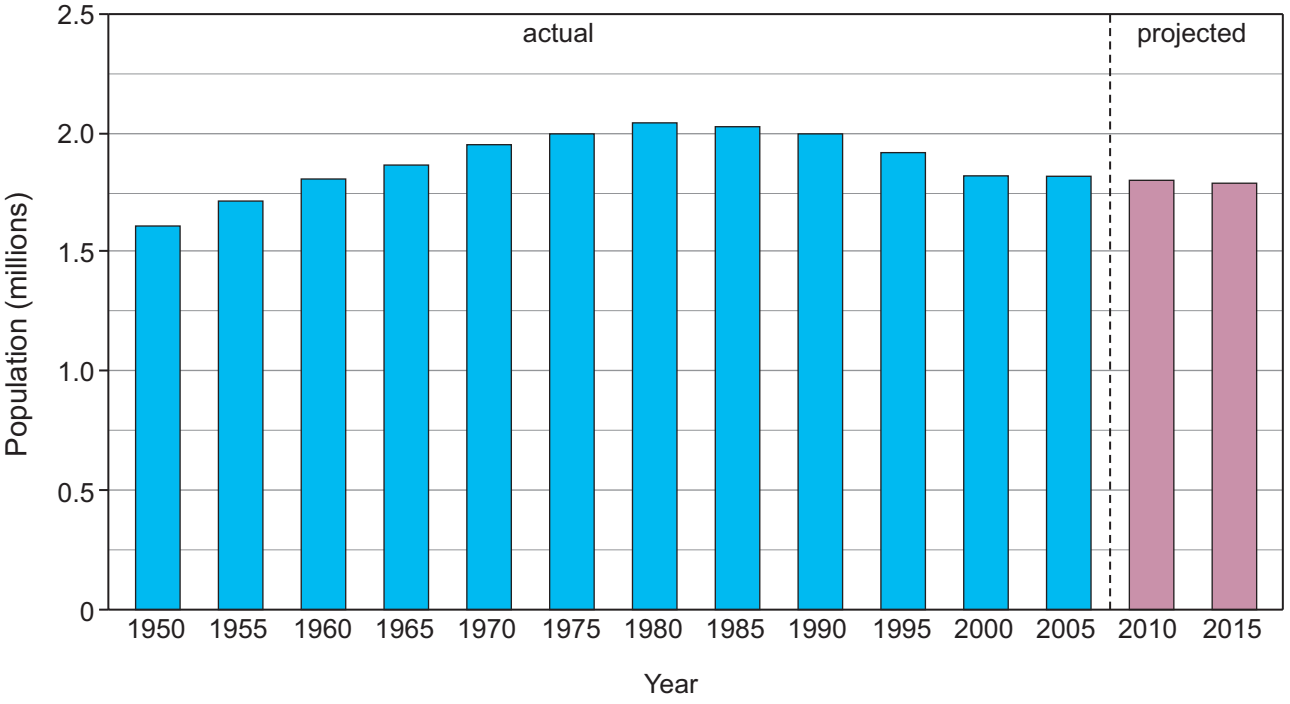
Figure 6: Population structure of Bamako, 2009



Source: mci.ei.columbia.edu

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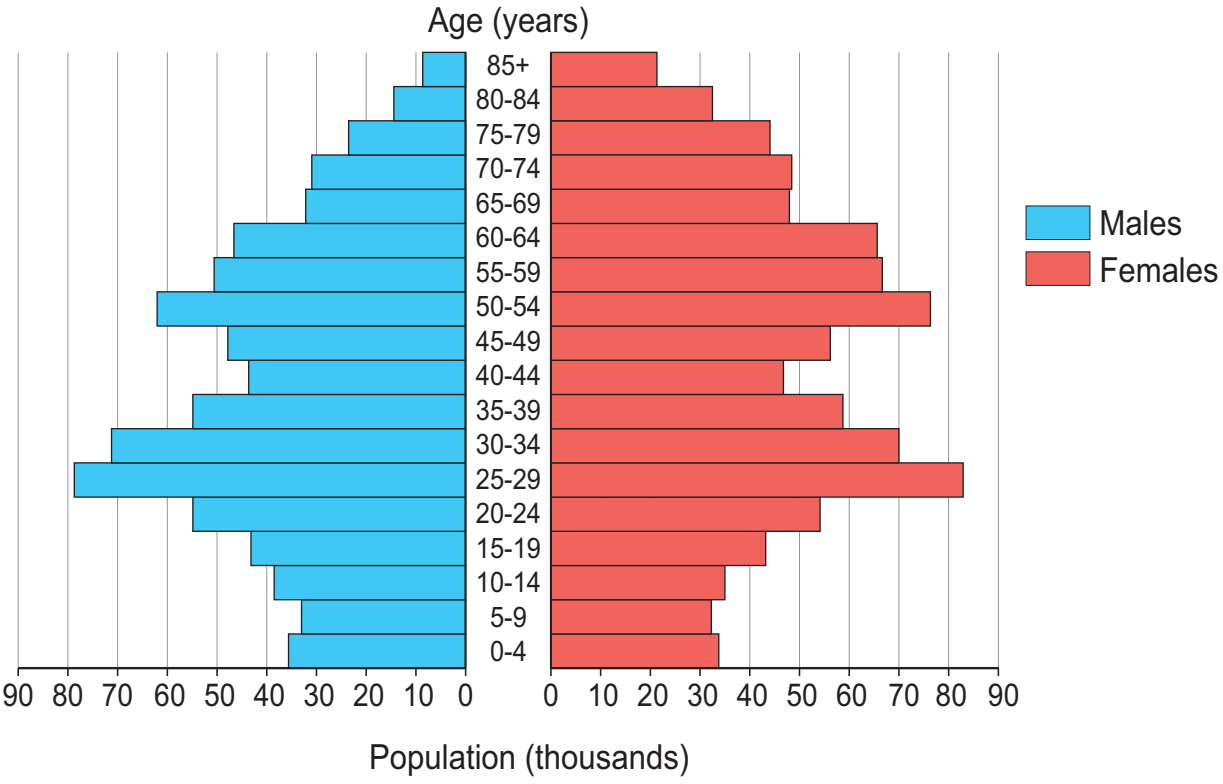
Figure 7: Population change in Budapest, Hungary



Source: adapted from books.mongabay.com

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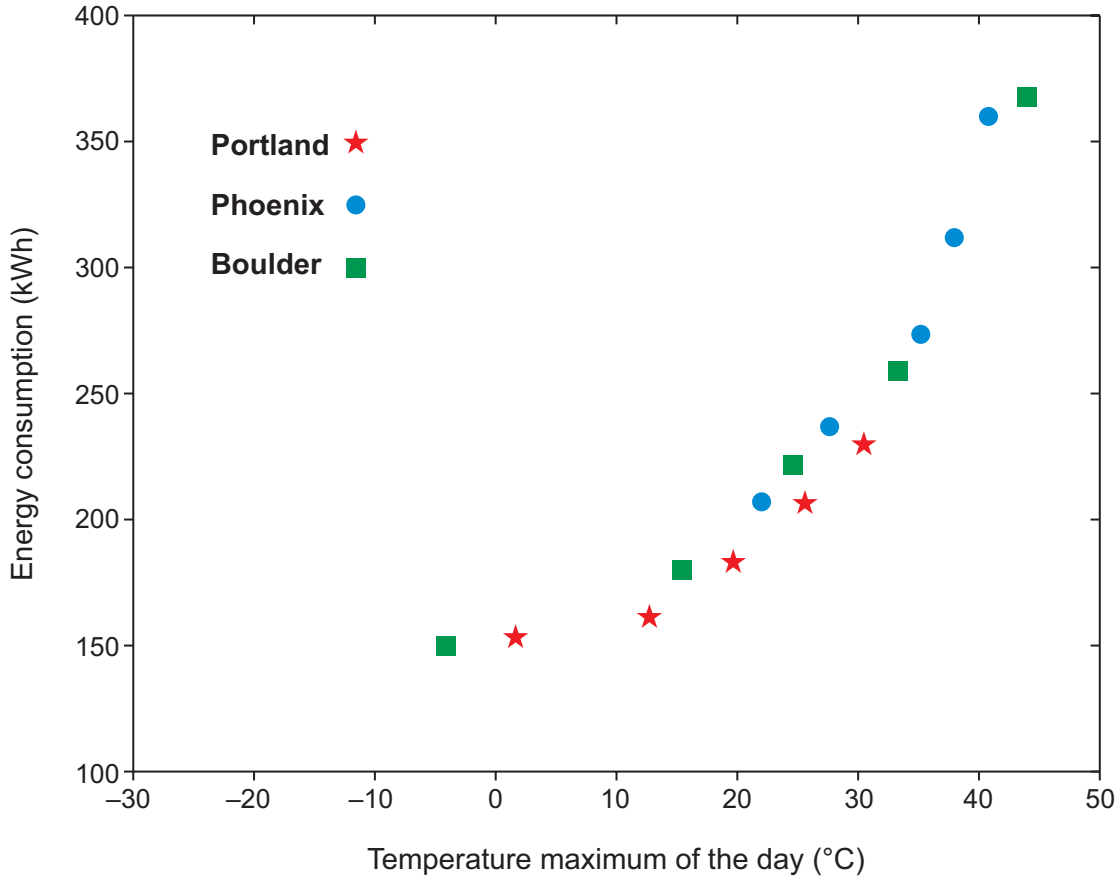
Figure 8: Population structure of Budapest, 2005



Source: fr.academic.ru

Turn over.

Figure 9: Relationship between temperature and energy consumption in supermarkets in three cities in the USA



Source: adapted from earthgauge.net

Figure 10: Heating degree-days (HDDs) and cooling degree-days (CDDs)

Residential energy demand can be gauged by **degree-days**. A degree-day is the difference between a day's average temperature and 65°F (65°F = 18°C).

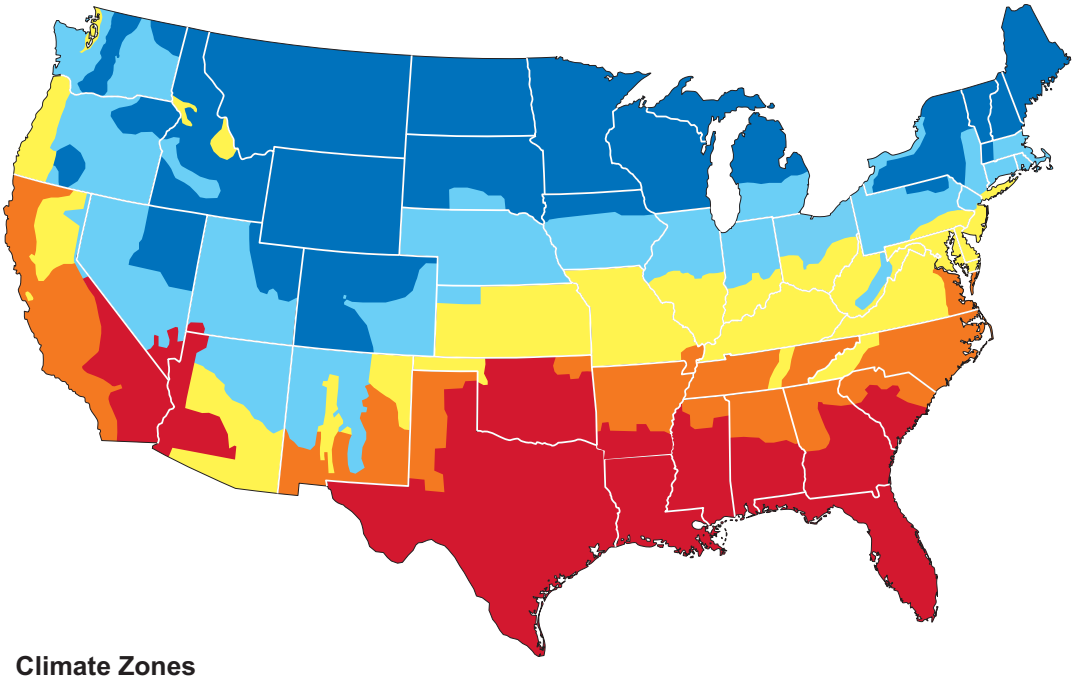
Heating degree-days (HDDs) are measured when the temperature is below 65°F. For example, if the day's average temperature was 55°F, the HDD would equal 10° (65° – 55° = 10°). A 30-day month of similar conditions would mean HDD equals 300°.

Cooling degree-days (CDDs) work the same way, but are for temperatures over 65°F. An average temperature of 75°F would mean CDD equals 10°.

Source: adapted from earthgauge.net

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Figure 11: Variations in heating and cooling requirements in mainland USA, 1960–2010



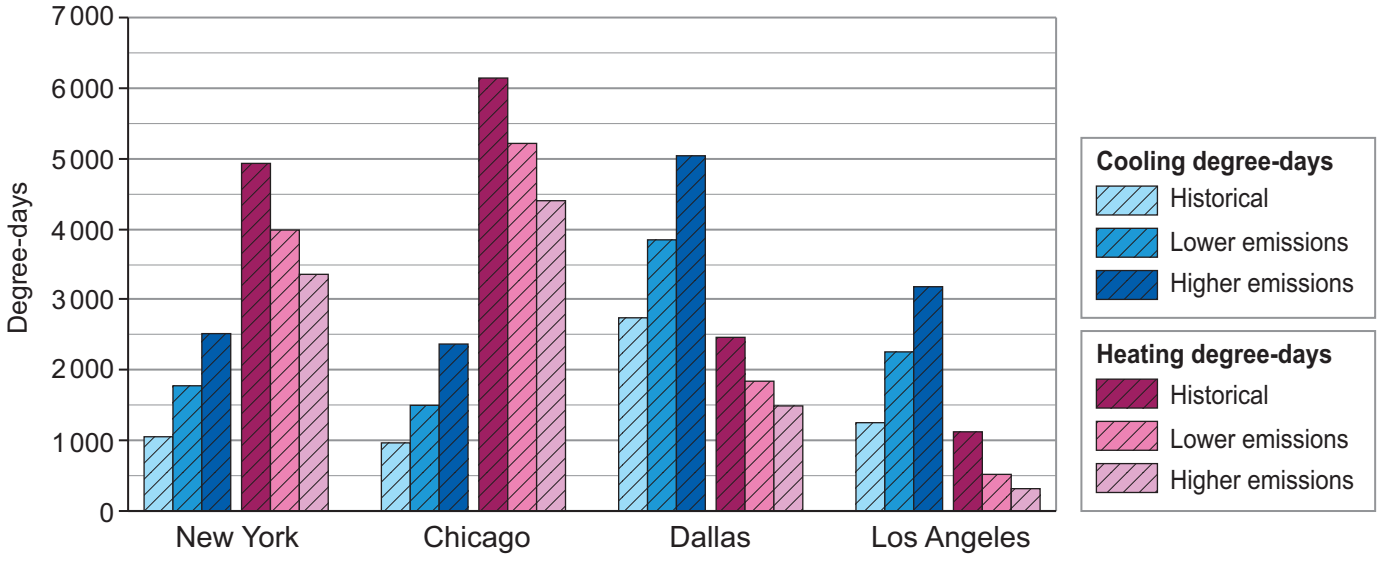
Climate Zones

- Zone 1 is less than 2,000 CDD and greater than 7,000 HDD
- Zone 2 is less than 2,000 CDD and between 5,500 and 7,000 HDD
- Zone 3 is less than 2,000 CDD and between 4,000 and 5,499 HDD
- Zone 4 is less than 2,000 CDD and less than 4,000 HDD
- Zone 5 is 2,000 CDD or more and less than 4,000 HDD

Source: earthgauge.net

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Figure 12: Predicted changes in heating and cooling degree-days for selected cities by 2080



Source: adapted from epa.gov

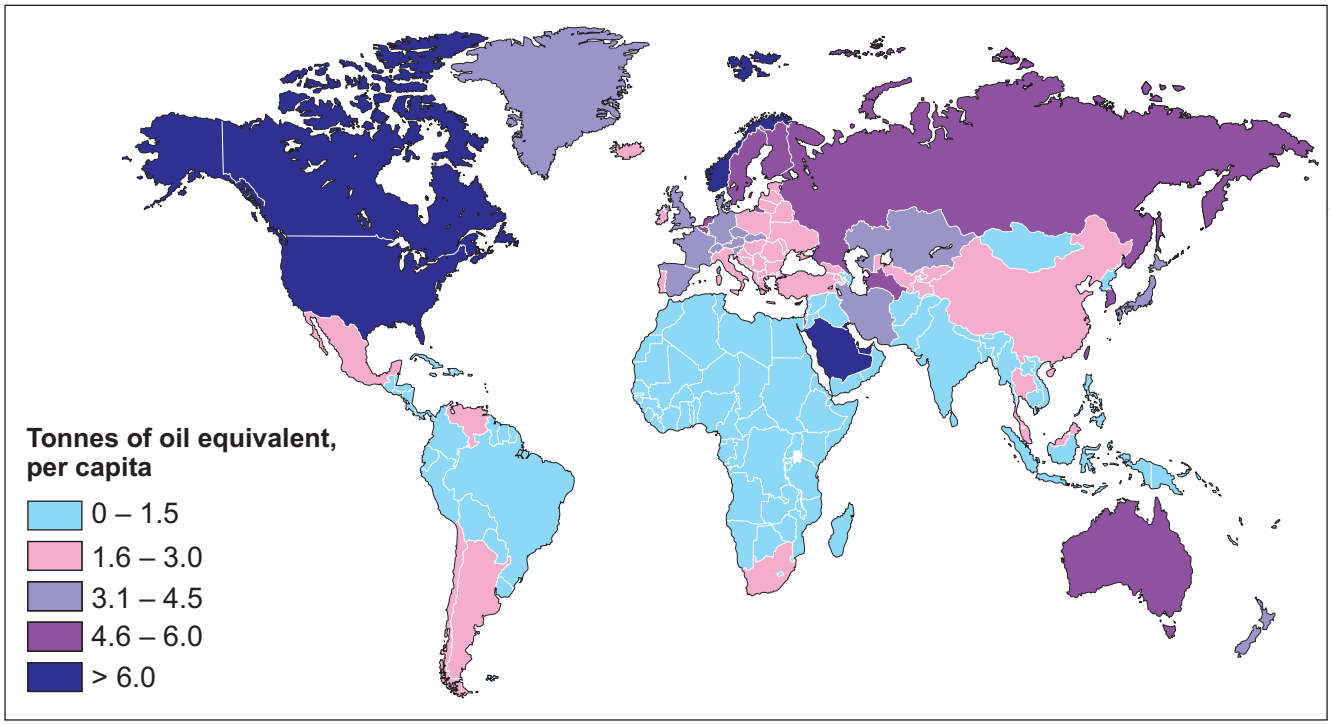
The estimates above are based on an expectation of a rise in temperature from climate change. It shows two predictions, one where increases in emissions are lower than in the past, and one where emissions increase at higher rates.

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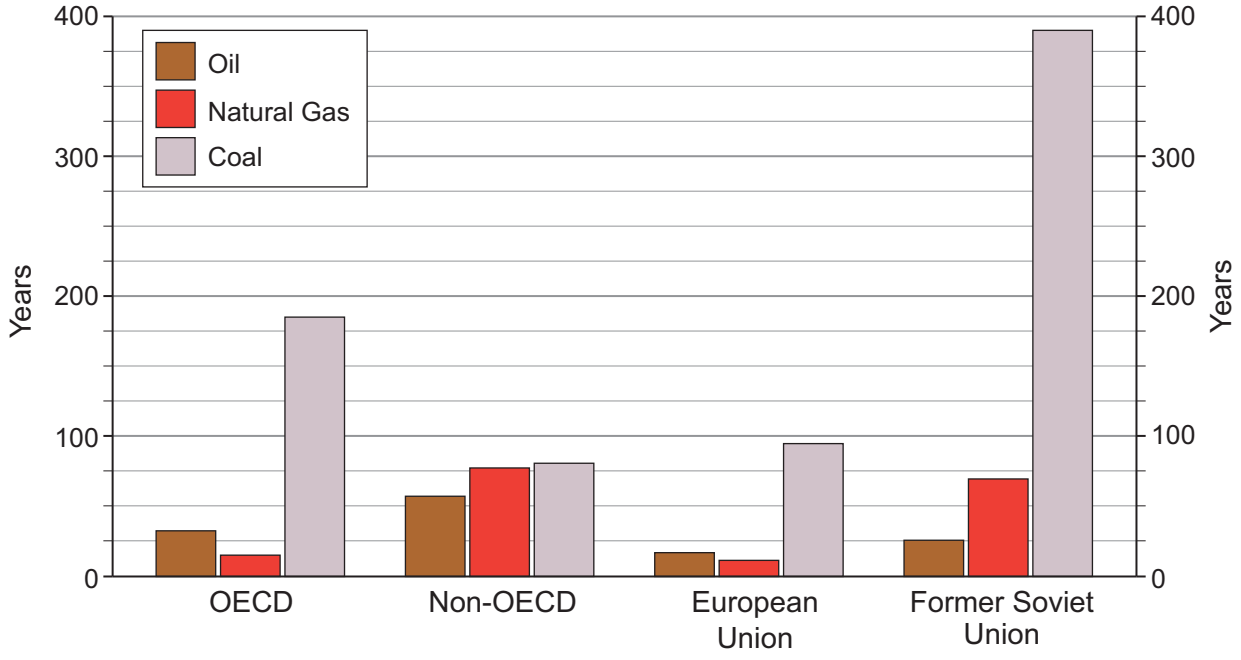
ENERGY ISSUES

Figure 13: Global energy consumption per capita, 2012



Source: bp.com

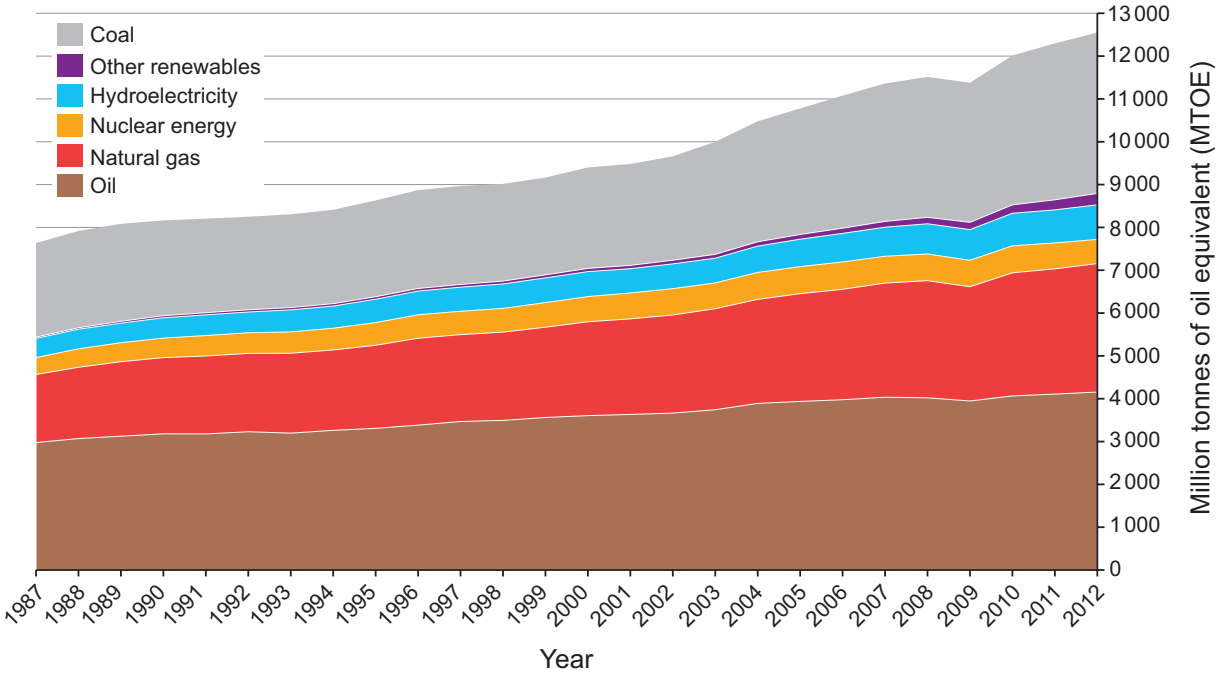
Figure 14: Expected number of years of indigenous fossil fuels available after 2012 in selected regions



Source: bp.com

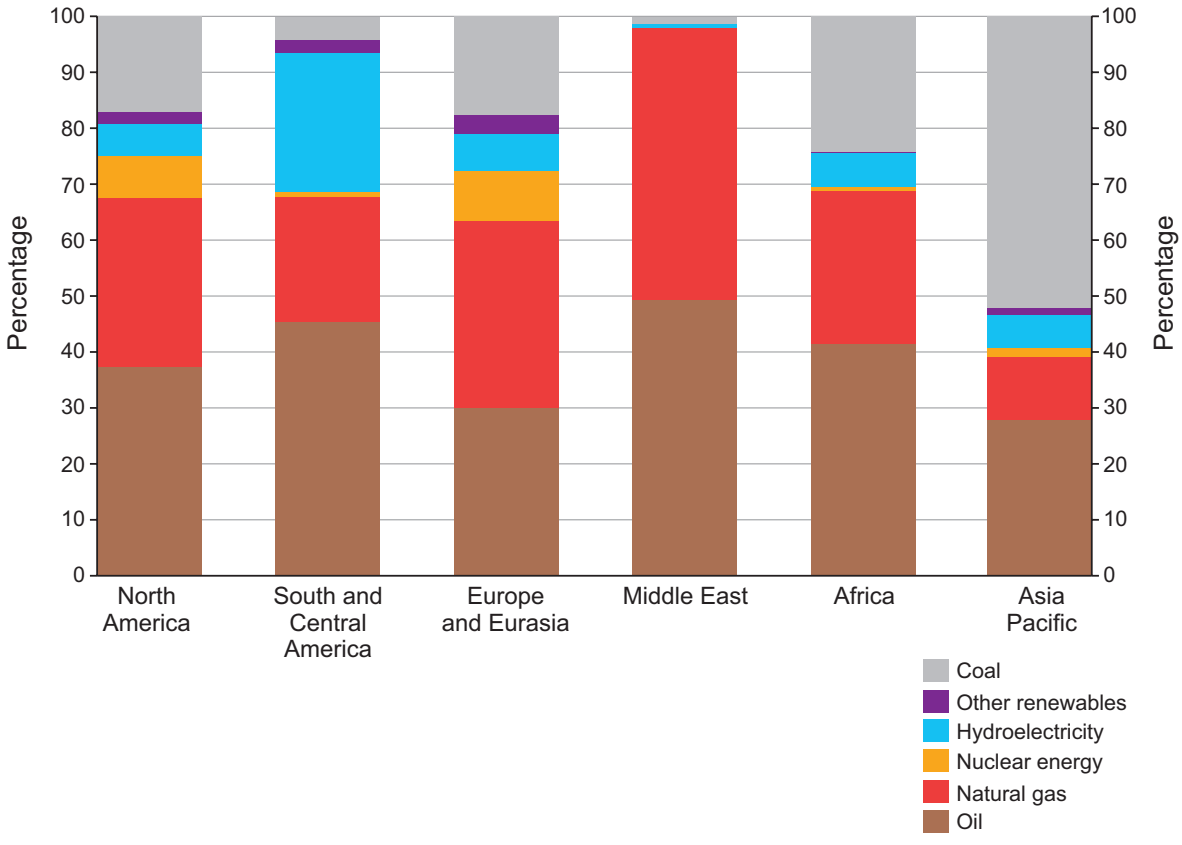
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Figure 15: Global growth of energy consumption by source, 1987–2012



Source: bp.com

Figure 16: The energy consumption mix of world regions, 2012

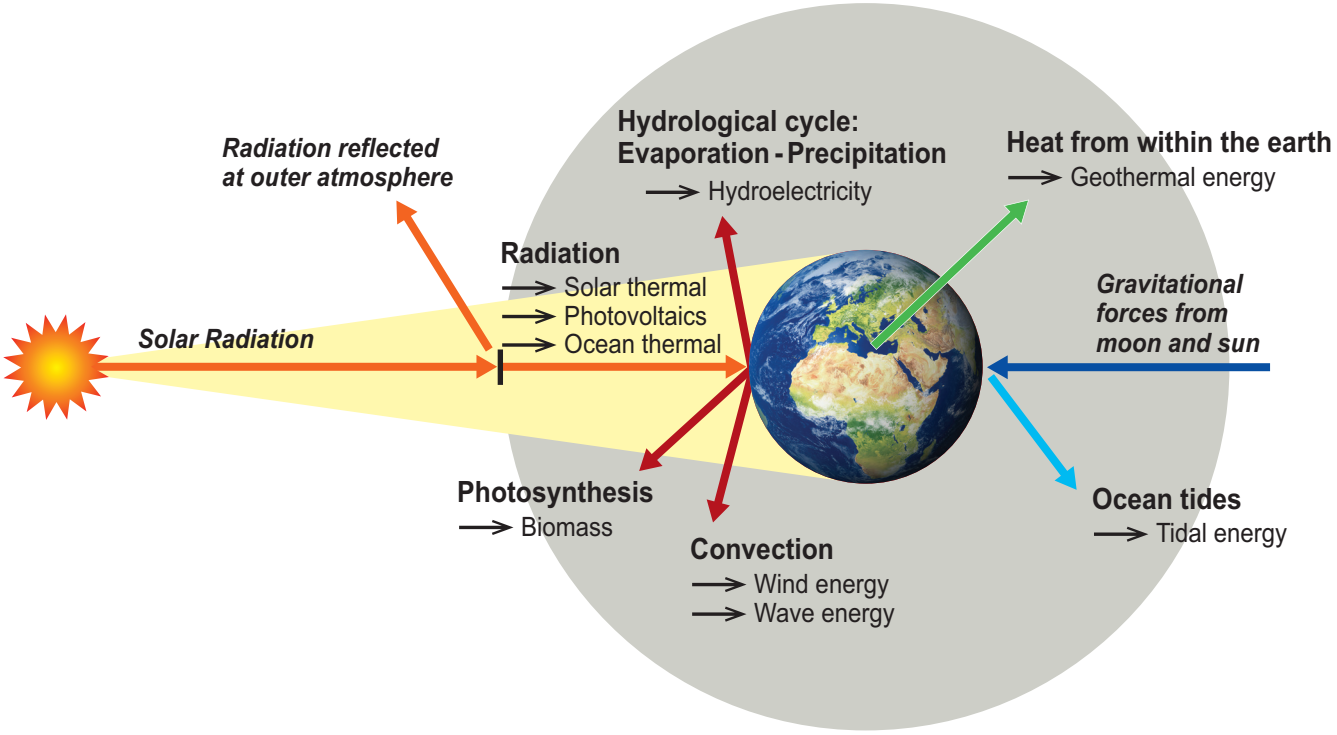


Source: bp.com

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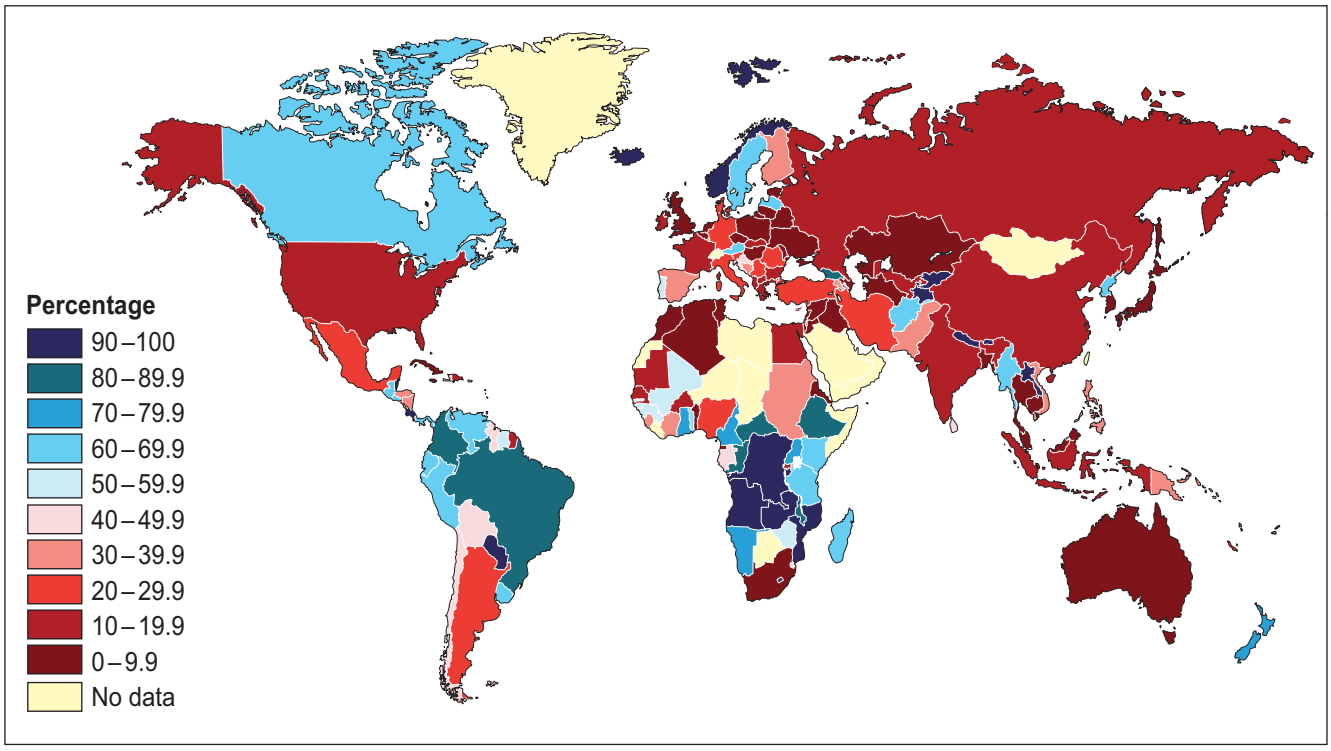
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Figure 17: Alternative sources of energy



Source: adapted from greenrhinoenergy.com

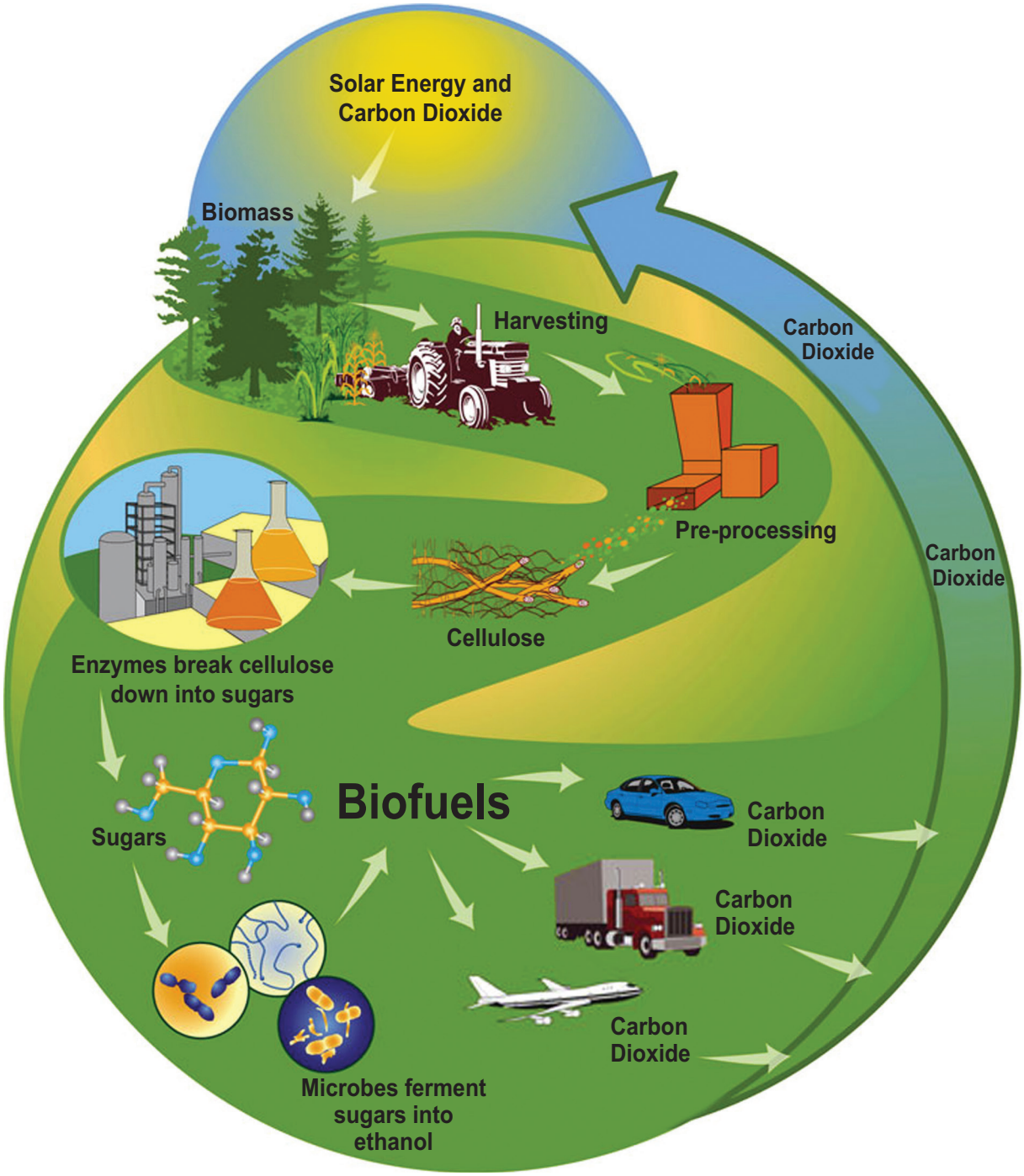
Figure 18: Percentage of electrical energy produced from alternative sources, 2012



Source: www.geocurrents.info

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Figure 19: Process of producing biofuels

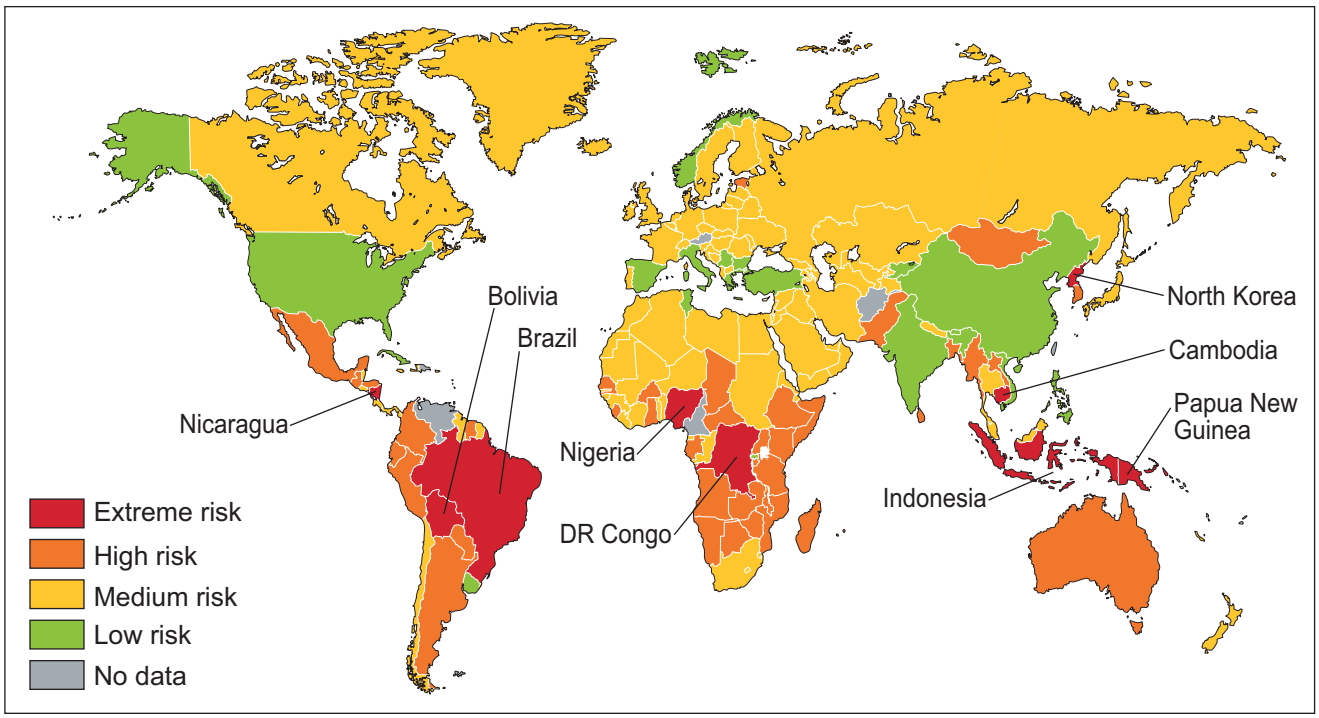


Source: whyfiles.org

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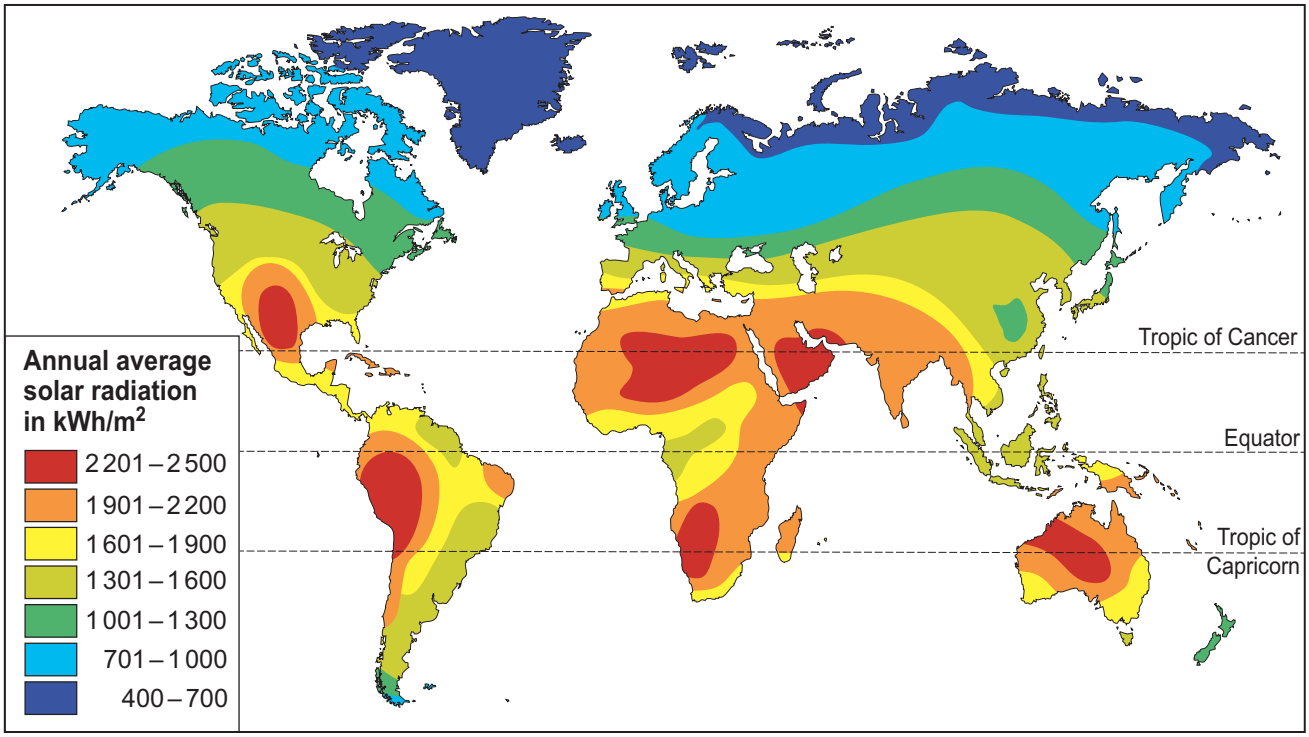
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Figure 20: Areas where biofuel production increased the risk of deforestation in 2012



Source: maplecroft.com

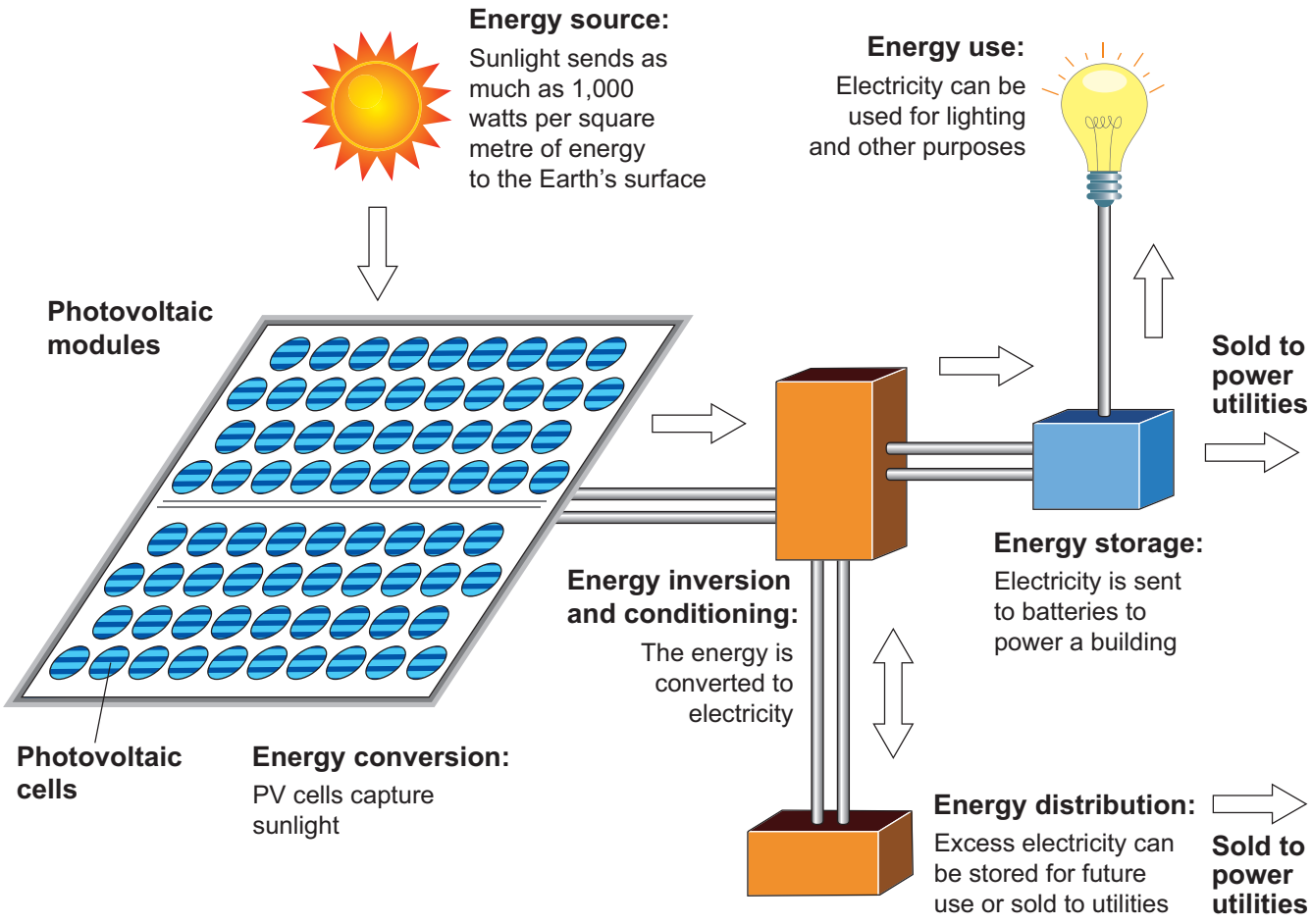
Figure 21: World solar energy potential



Source: micro-hydro-power.com

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Figure 22: Production of solar photovoltaic (PV) energy



Source: adapted from solarenergyprosandcons.com

Figure 23: Costs of generating energy from different sources

Source	Cost per MWh (US$)	CO2 per MWh (kg)
Coal	85.6	888
Oil	90.8	735
Natural gas	66.3	500
Nuclear	96.1	28
Biomass	102.6	45
Wind	80.3	26
Solar photovoltaic	130.0	85
Hydroelectric	84.5	26

1 tonne = 1 000 kilograms (kg)

Source: adapted from www.eon-uk.com
www.eia.gov
www.world-nuclear.org

Sources of information and copyright

Figures 1-3	http://iph-partnership.org/index.php?title=Urbanisation_and_the_future_of_PHC
Figure 4	http://www.demographia.com/db-intlcityloss.htm
Figure 5	http://books.mongabay.com/population_estimates/full/Bamako-Mali.html
Figure 6	http://mci.ei.columbia.edu/millennium-cities/bamako-mali/bamako-population-data/ http://mci.ei.columbia.edu/research-publications/population-data/bamako-population
Figure 7	http://books.mongabay.com/population_estimates/full/Budapest-Hungary.html
Figure 8	http://fr.academic.ru/pictures/frwiki/80/Population_pyramid_of_Budapest.png
Figures 9-11	http://www.earthgauge.net/wp-content/CF_Weather_and_Energy.pdf
Figure 12	http://www3.epa.gov/climatechange/impacts/energy.html
Figures 13-16	http://www.bp.com/content/dam/bp/pdf/statistical-review/statistical_review_of_world_energy_2013.pdf
Figure 17	http://greenrhinoenergy.com/renewable/
Figure 18	http://www.geocurrents.info/geonotes/mapping-renewable-electricity-generation
Figure 19	http://whyfiles.org/2010/biofuel-advance/
Figure 20	http://maplecroft.com/portfolio/new-analysis/2012/01/02/maplecrofts-deforestation-index/
Figure 21	http://www.micro-hydro-power.com/Solar-Powered-Water-Pumping.htm
Figure 22	http://solarenergyprosandcons.com/solar-energy/solar-panels-and-how-they-work
Figure 23	http://www.eon-uk.com/EnergyExperience/853.htm http://www.eia.gov/forecasts/aeo/pdf/electricity_generation.pdf http://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working_Group_Reports/comparison_of_lifecycle.pdf

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GCE A level

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S16-1204-01B

GEOGRAPHY – G4
Sustainability

Pre-Release Material for examination on 16 June 2016.

To be opened on receipt.

A new copy of this Folder will be given out in the examination.

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RESOURCE FOLDER

INSTRUCTIONS TO CANDIDATES

A new copy of this Folder will be given out in the examination. **This copy must not be taken into the examination**.

Work through this Folder to make sure you understand all the resources. You may seek help from your teachers or any other sources in this context. You have to apply your critical understanding to an unfamiliar situation.

ADVICE TO CANDIDATES

The materials in this Folder provide information on cities, their growth, their use of energy, and on supplies of energy that can be used in cities.

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Guidelines for using the pre-release materials

The contents of the booklet should be studied carefully. The examples given will help in answering some of the questions on the question paper. To give a fuller answer, it is advisable to look at other material before the examination. This could be similar topics, related to information in other countries, or may be the same countries but in greater depth or on closely related topics. It would be particularly useful to note if other case studies seem similar in nature, or if they show contrasting perspectives to those from the material in this Resource Folder.

Some of the resource materials come from Geography textbooks, but others come from companies, pressure groups, research organisations, governments and private individuals. In some cases they are using information to promote their own interests rather than to represent an impartial view. It is worth considering if they are trying to support a particular interest group and persuade readers to agree with them. In finding other materials, it is worth bearing in mind that they might not be presented in an impartial and objective way.

Material in the Resource Folder may often be related to other themes found in G4, and to other units in Geography AS and A2. These links should be noted, as there will be opportunities to refer to such connections with other work in some of your answers. Being able to link together different parts of your Geography studies is important and will be credited. Such linkages are sometimes referred to as 'synopticity'.

Textbooks, journals, good quality newspapers and television and radio programmes are good sources of information. Probably the most accessible source of geographical information is the Internet, but it is also the one which may be most susceptible to bias and lack of impartiality. Many of the resources are extracted or adapted from sources on the Internet. These sources have the web addresses provided only for copyright reasons. Many are only extracts or shortened versions of fuller documents and some may be inaccessible by the date of the release of this Resource Folder. Following some of these links for greater depth of reading and for more recent updates of material can be helpful but is not essential. It is **not** the intention that by providing these web addresses every one listed is researched.

Each candidate will be provided with a copy of the Resource Folder, for use in the examination, at the same time as the question paper is issued at the beginning of the examination on the day set for the paper.

Copies of the Resource Folder with added notes, or notes from research carried out in the previous six weeks, may not be taken into the examination.

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ENERGY ISSUES

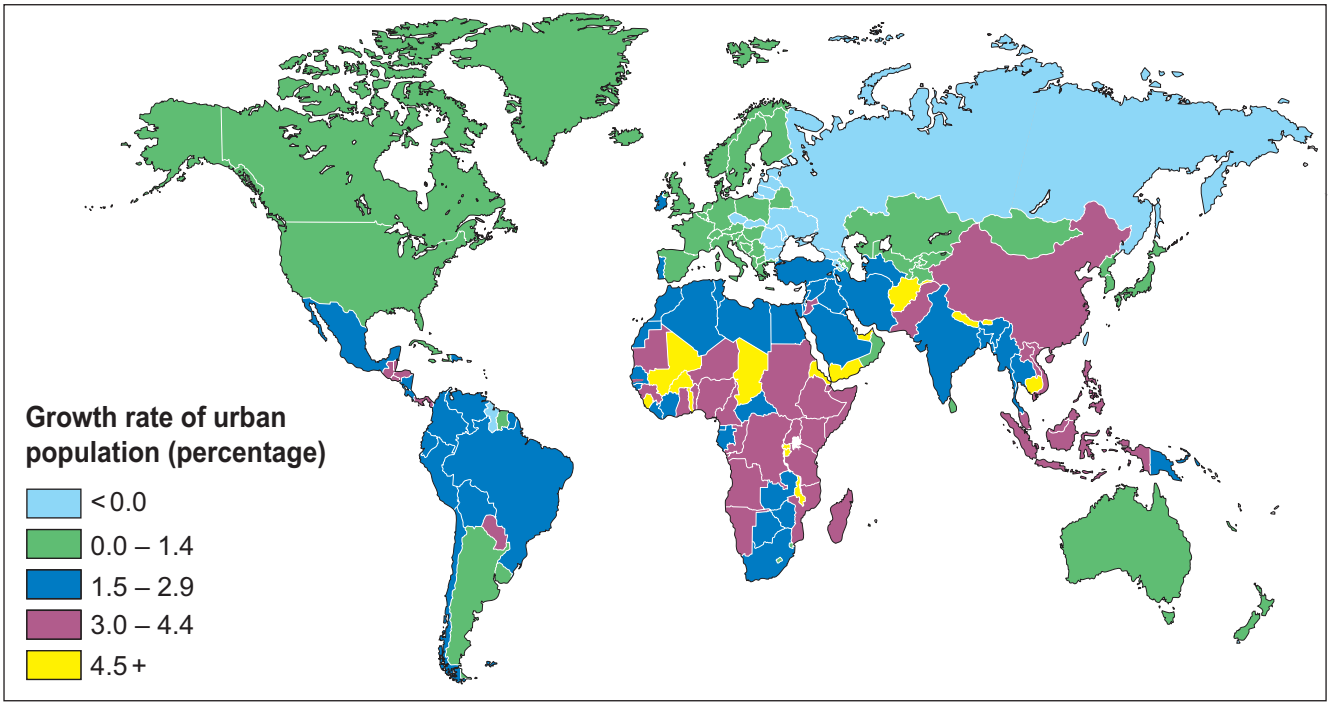
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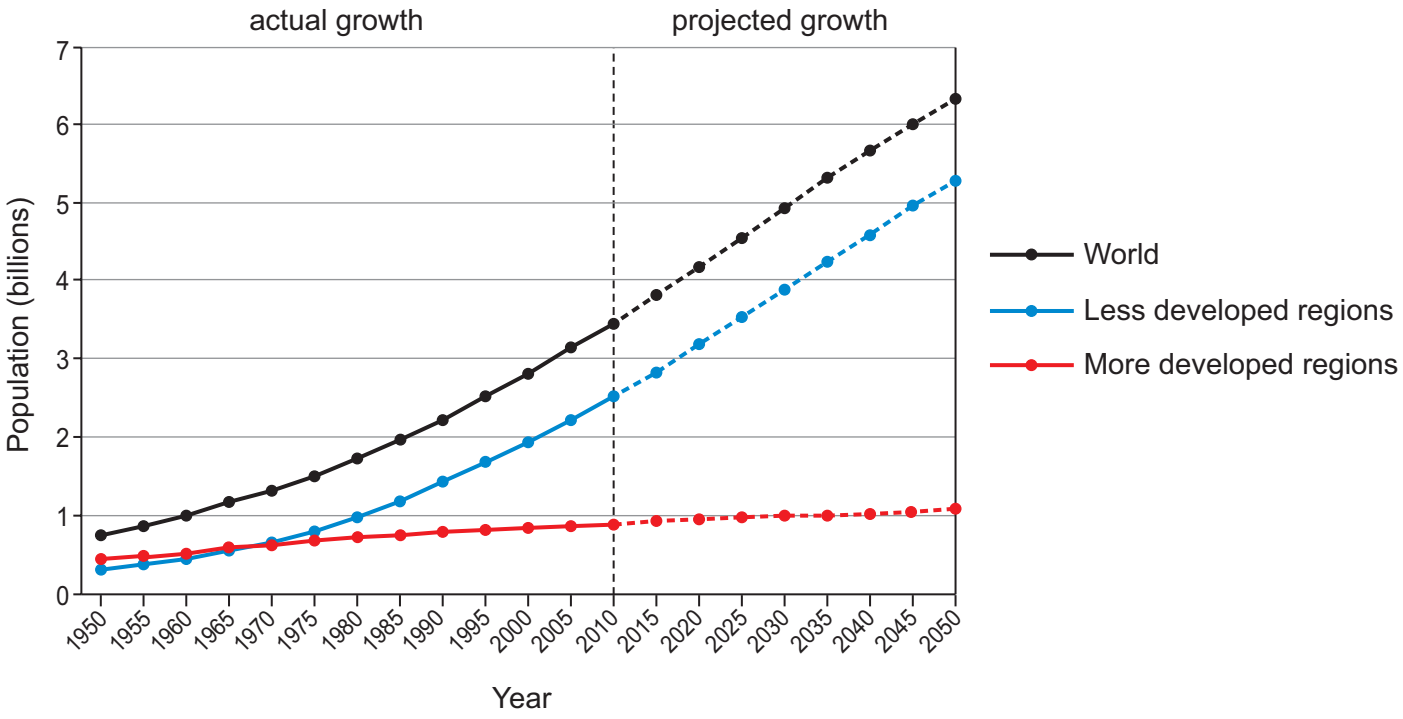
CHANGING CITIES

Figure 1: Average annual growth of urban population by country, 2000–2005



Source: iph-partnership.org

Figure 2: Actual and projected growth of urban population in more developed regions, less developed regions and the world



Source: iph-partnership.org

© WJEC CBAC Ltd.

Figure 3: Selected fastest growing cities in the world with populations over 10 million in 2007

City	Population 1975 (millions)	Population 2007 (millions)	Annual percentage change 1975–2007
Mexico City	10.7	19.0	1.8
Mumbai	7.1	19.0	3.1
Sao Paulo	9.6	18.8	2.1
Delhi	4.4	15.9	4.0
Shanghai	7.3	15.0	2.2
Dhaka	2.2	13.5	5.6
Karachi	4.0	12.1	3.5
Beijing	6.0	11.1	1.9
Manila	5.0	11.1	2.5
Istanbul	3.6	10.1	3.2

Source: adapted from iph-partnership.org

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Figure 4: Selected cities with low or negative growth rates

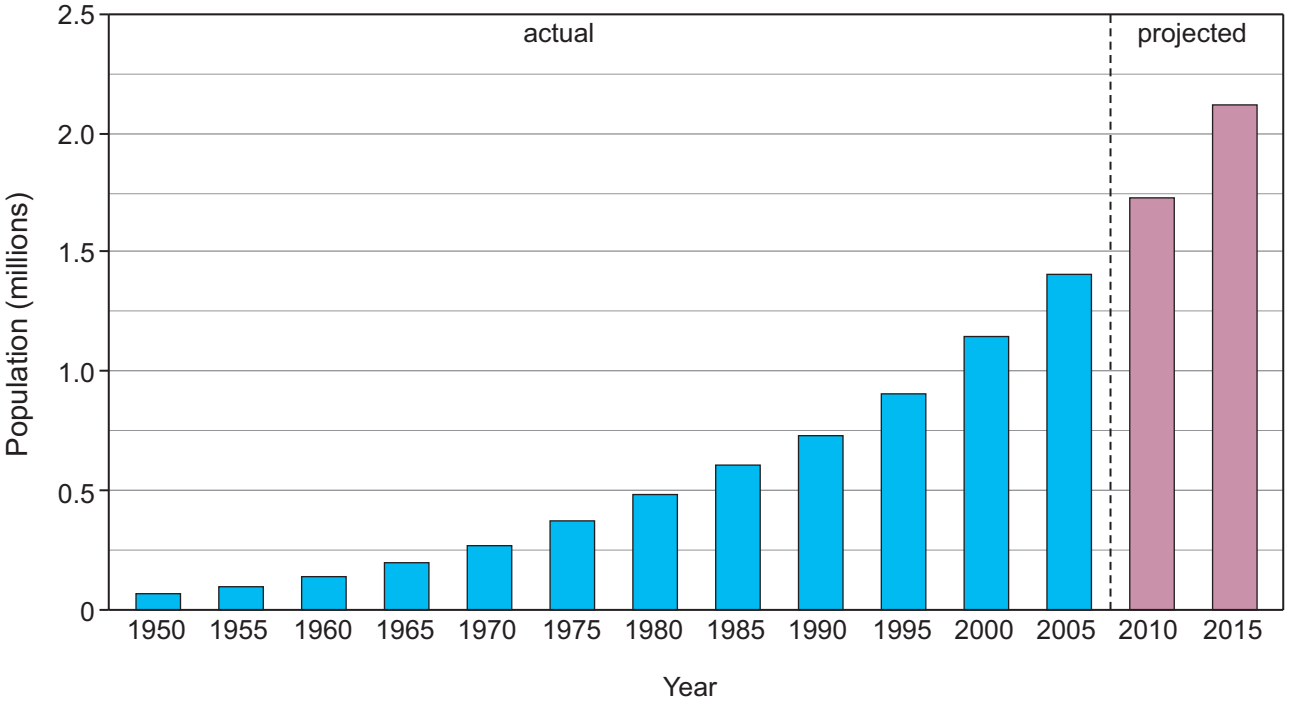
City	Population 1975 (millions)	Population 2010 (millions)	Annual percentage change 1975–2010
Tokyo	19.8	26.4	0.9
New York	15.9	17.2	0.2
Osaka	9.8	11.0	0.4
Paris	8.9	9.7	0.3
London	8.6	7.6	–0.3
Moscow	7.6	9.3	0.6
Rome	2.9	2.7	–0.2
Budapest	2.0	1.8	–0.3
Pittsburgh	1.8	1.8	0.0
Riga	0.9	0.8	–0.3

Sources: adapted from www.demographia.com

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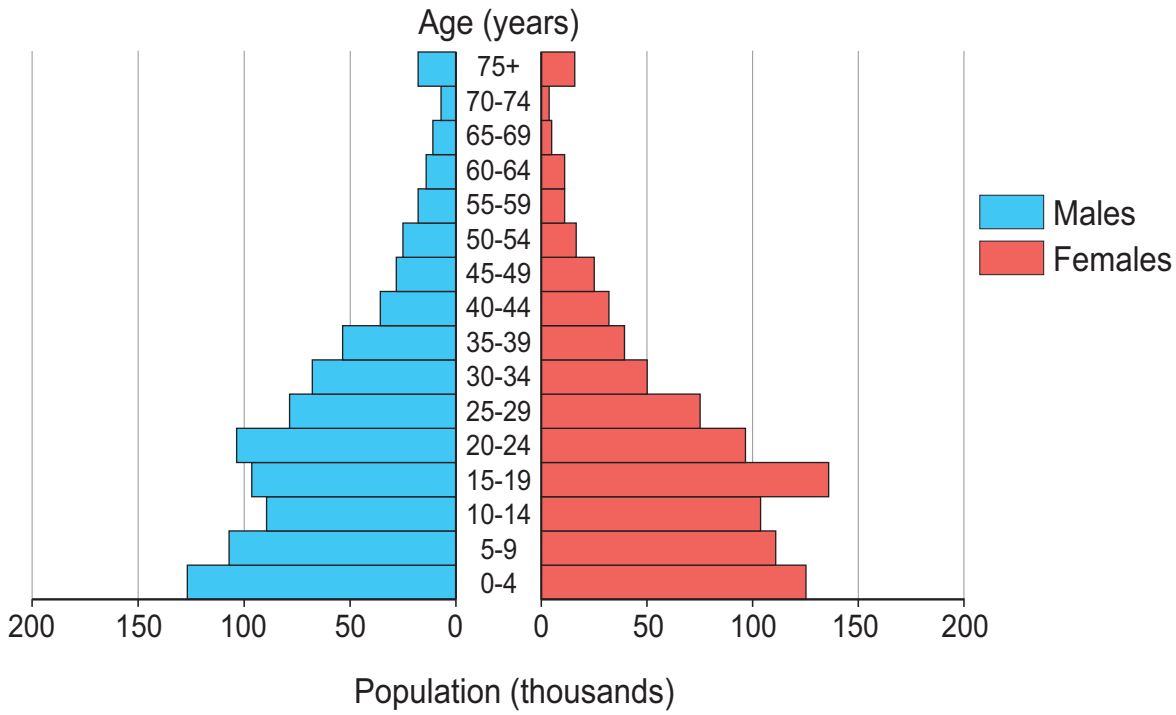
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Figure 5: Population change in Bamako, Mali



Source: books.mongabay.com

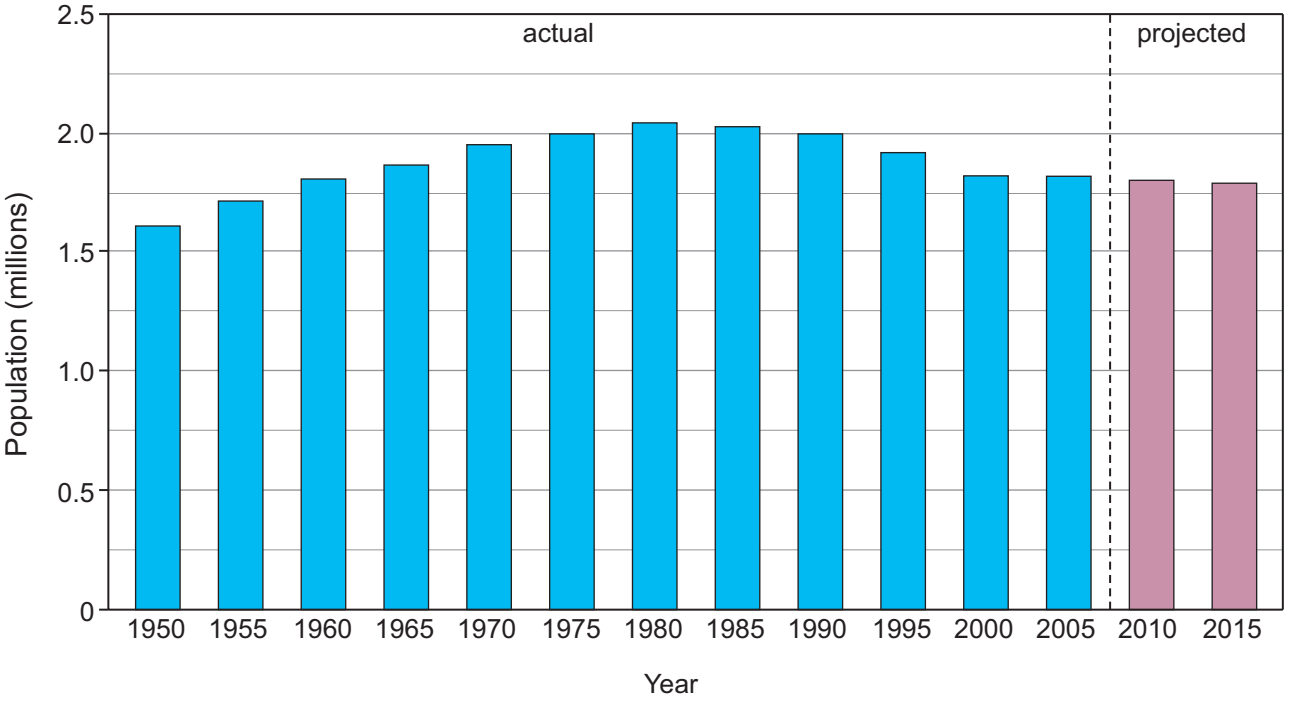
Figure 6: Population structure of Bamako, 2009



Source: mci.ei.columbia.edu

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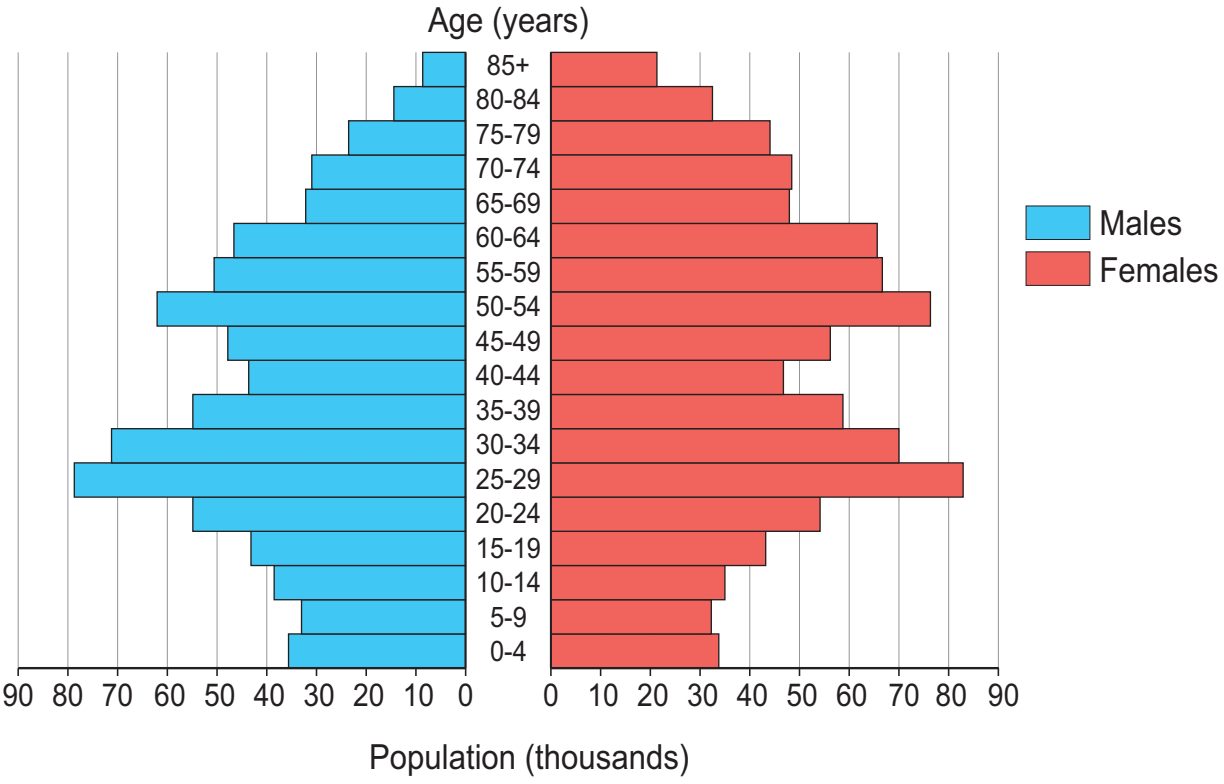
Figure 7: Population change in Budapest, Hungary



Source: adapted from books.mongabay.com

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Figure 8: Population structure of Budapest, 2005

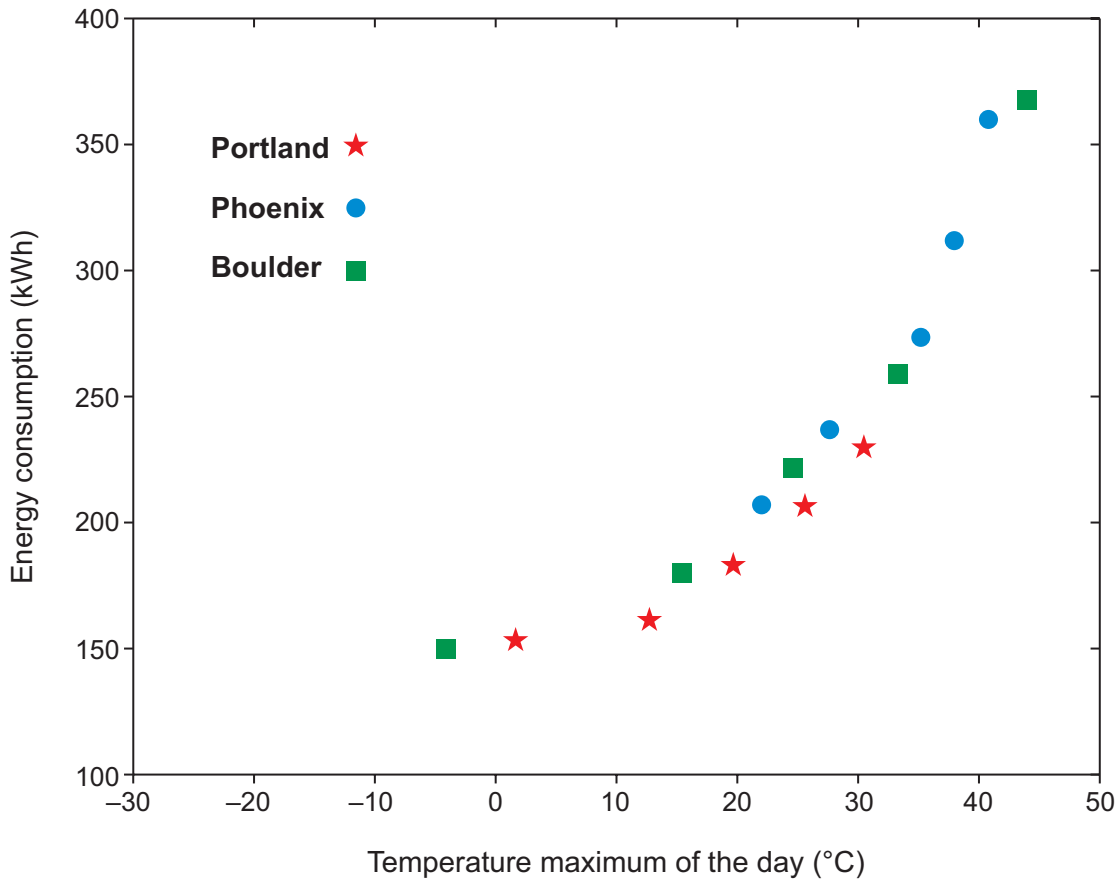


Source: fr.academic.ru

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Figure 9: Relationship between temperature and energy consumption in supermarkets in three cities in the USA



Source: adapted from earthgauge.net

Figure 10: Heating degree-days (HDDs) and cooling degree-days (CDDs)

Residential energy demand can be gauged by **degree-days**. A degree-day is the difference between a day's average temperature and 65°F (65°F = 18°C).

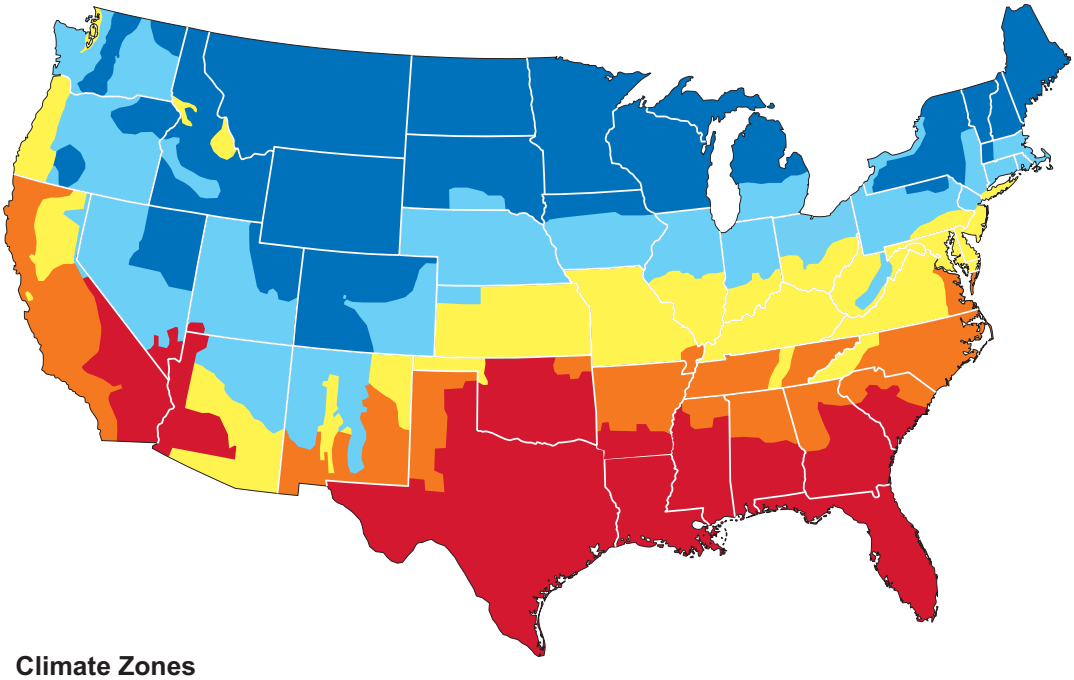
Heating degree-days (HDDs) are measured when the temperature is below 65°F. For example, if the day's average temperature was 55°F, the HDD would equal 10° (65° – 55° = 10°). A 30-day month of similar conditions would mean HDD equals 300°.

Cooling degree-days (CDDs) work the same way, but are for temperatures over 65°F. An average temperature of 75°F would mean CDD equals 10°.

Source: adapted from earthgauge.net

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Figure 11: Variations in heating and cooling requirements in mainland USA, 1960–2010



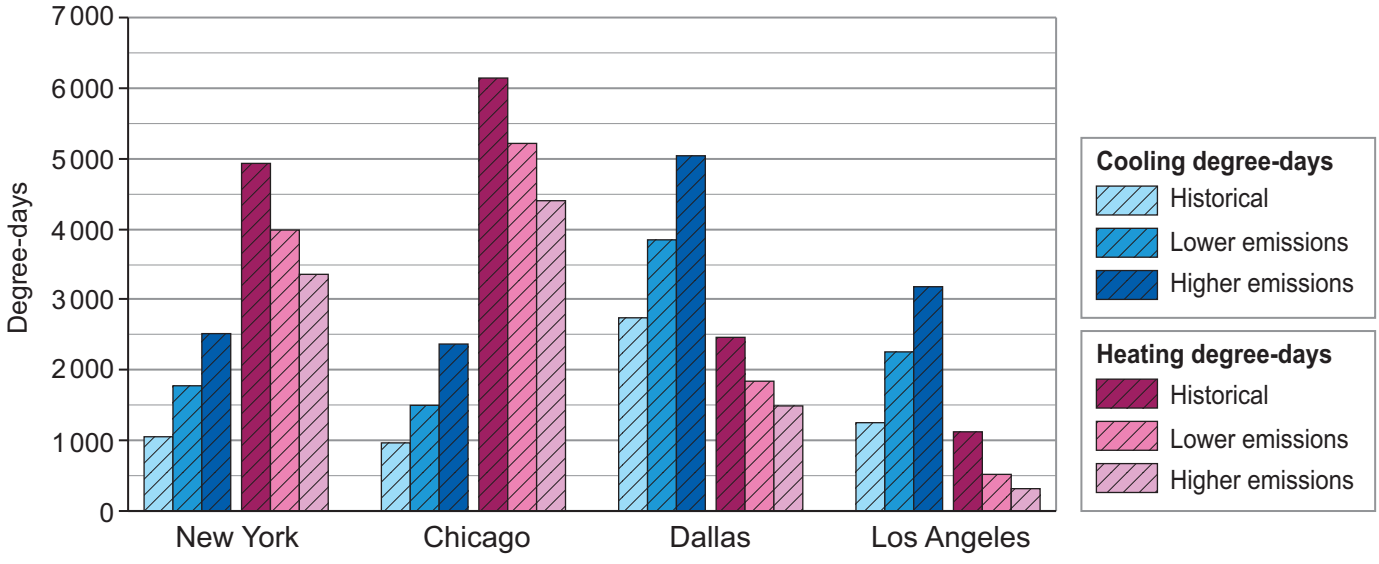
Climate Zones

- Zone 1 is less than 2,000 CDD and greater than 7,000 HDD
- Zone 2 is less than 2,000 CDD and between 5,500 and 7,000 HDD
- Zone 3 is less than 2,000 CDD and between 4,000 and 5,499 HDD
- Zone 4 is less than 2,000 CDD and less than 4,000 HDD
- Zone 5 is 2,000 CDD or more and less than 4,000 HDD

Source: earthgauge.net

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Figure 12: Predicted changes in heating and cooling degree-days for selected cities by 2080



Source: adapted from epa.gov

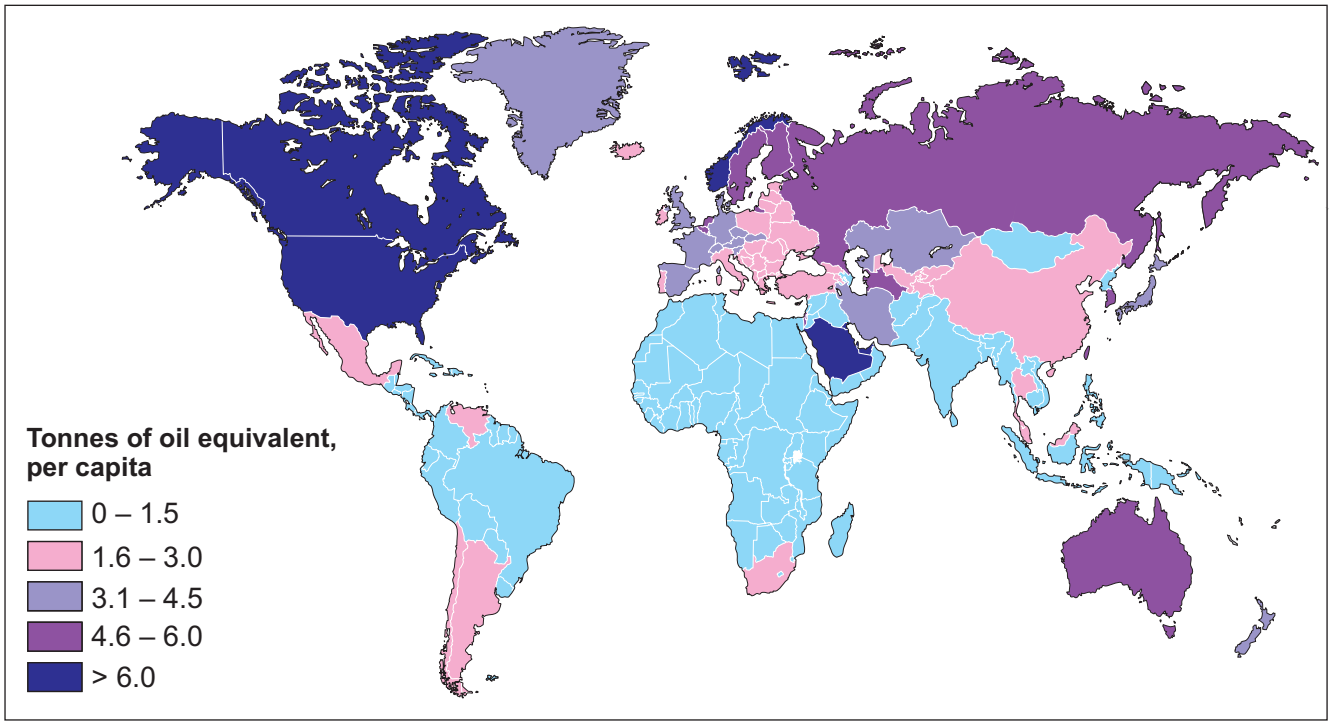
The estimates above are based on an expectation of a rise in temperature from climate change. It shows two predictions, one where increases in emissions are lower than in the past, and one where emissions increase at higher rates.

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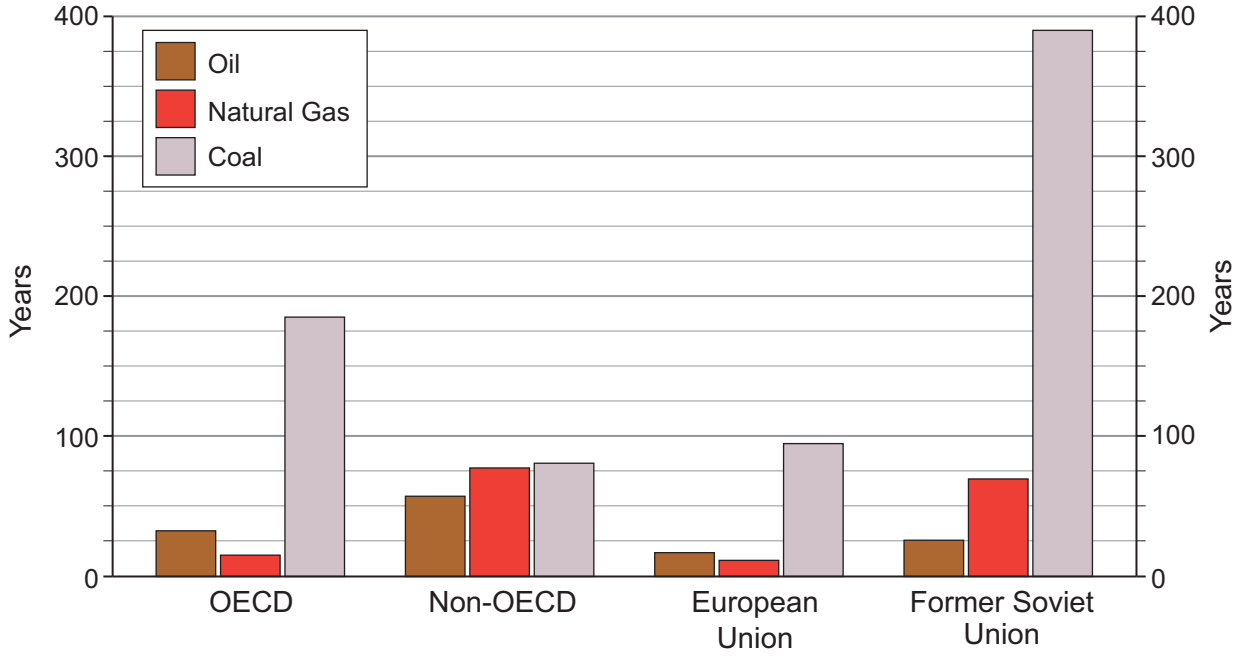
ENERGY ISSUES

Figure 13: Global energy consumption per capita, 2012



Source: bp.com

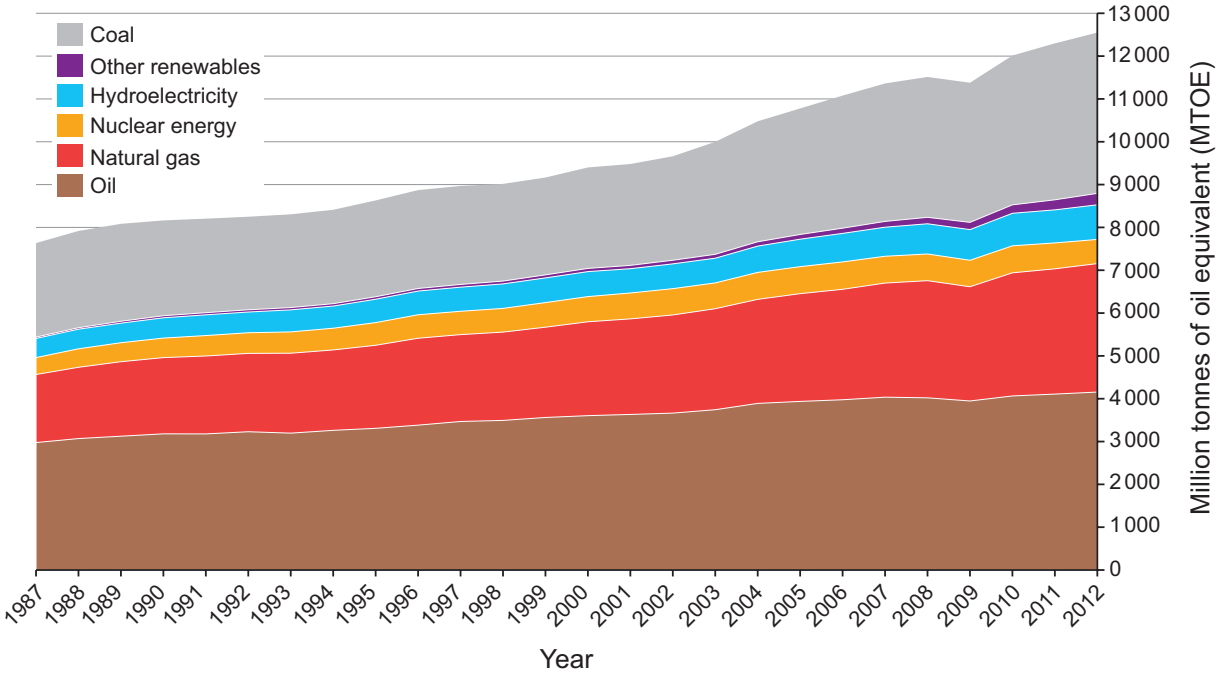
Figure 14: Expected number of years of indigenous fossil fuels available after 2012 in selected regions



Source: bp.com

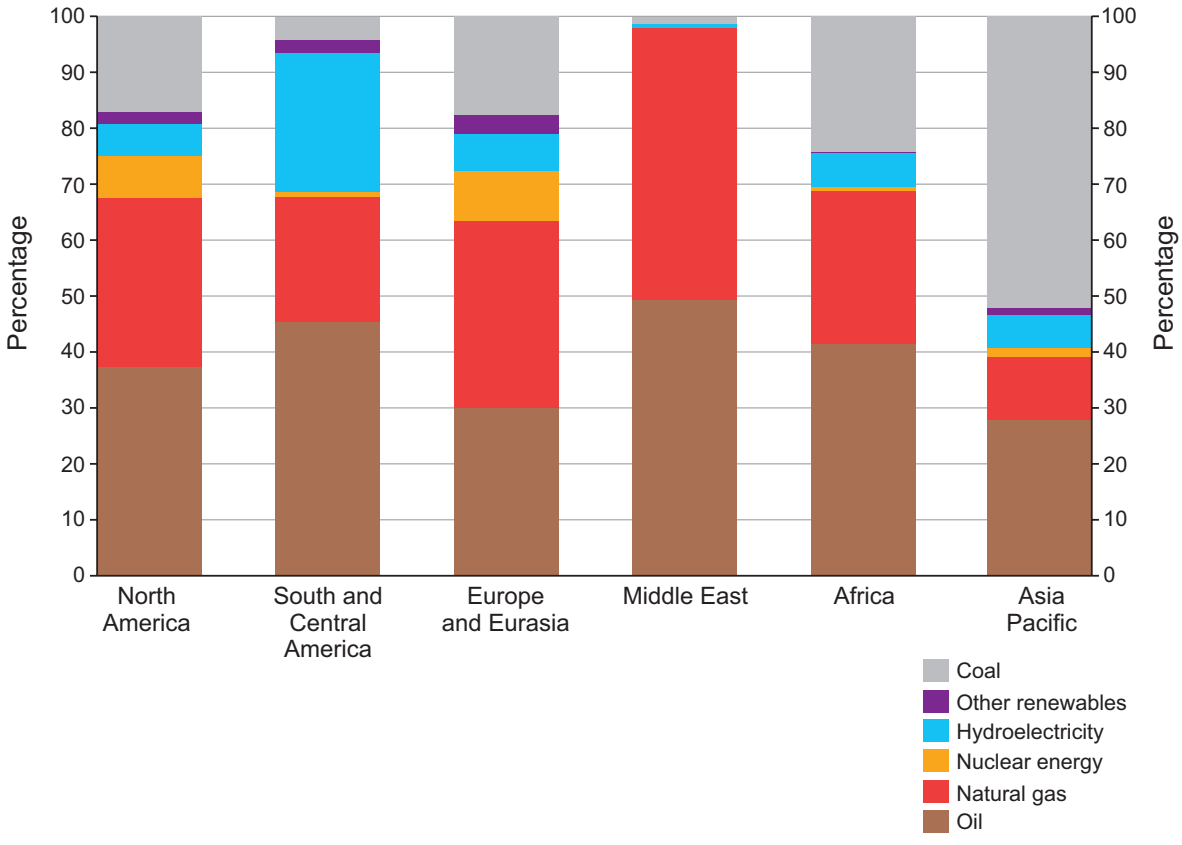
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Figure 15: Global growth of energy consumption by source, 1987–2012



Source: bp.com

Figure 16: The energy consumption mix of world regions, 2012

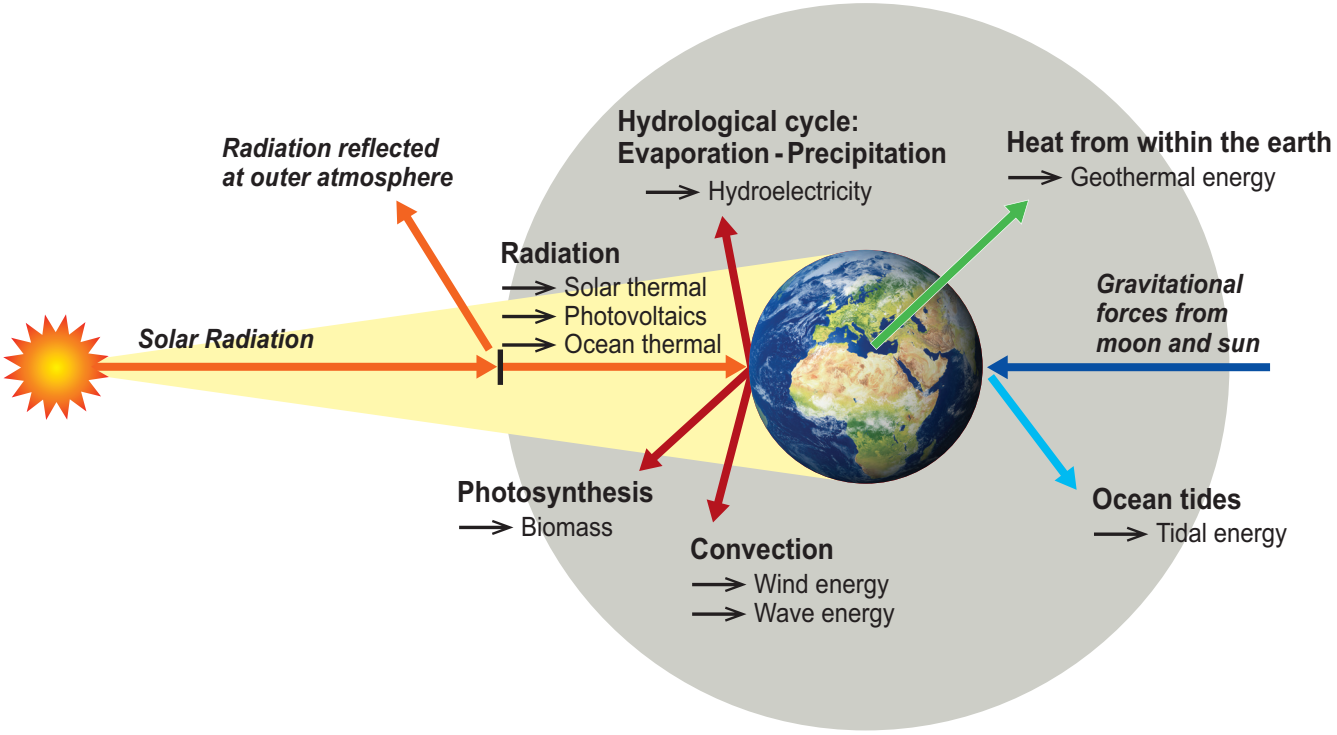


Source: bp.com

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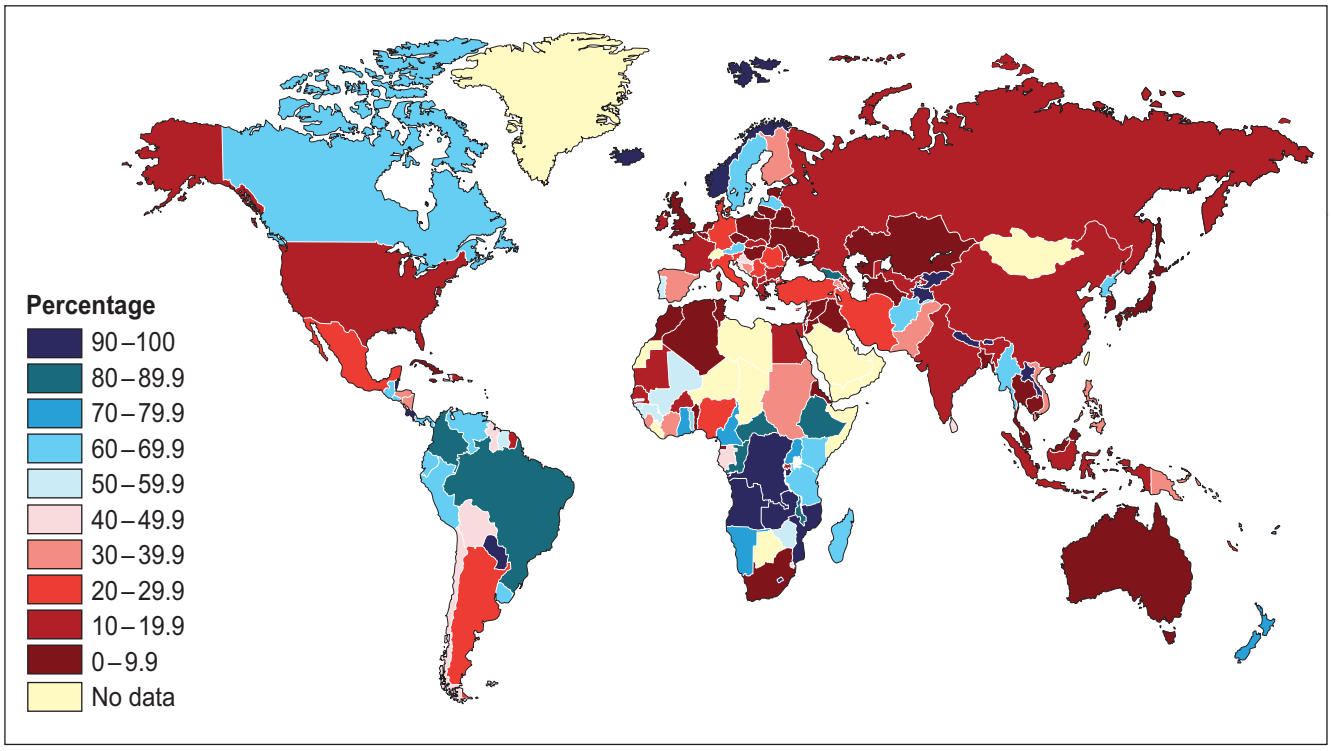
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Figure 17: Alternative sources of energy



Source: adapted from greenrhinoenergy.com

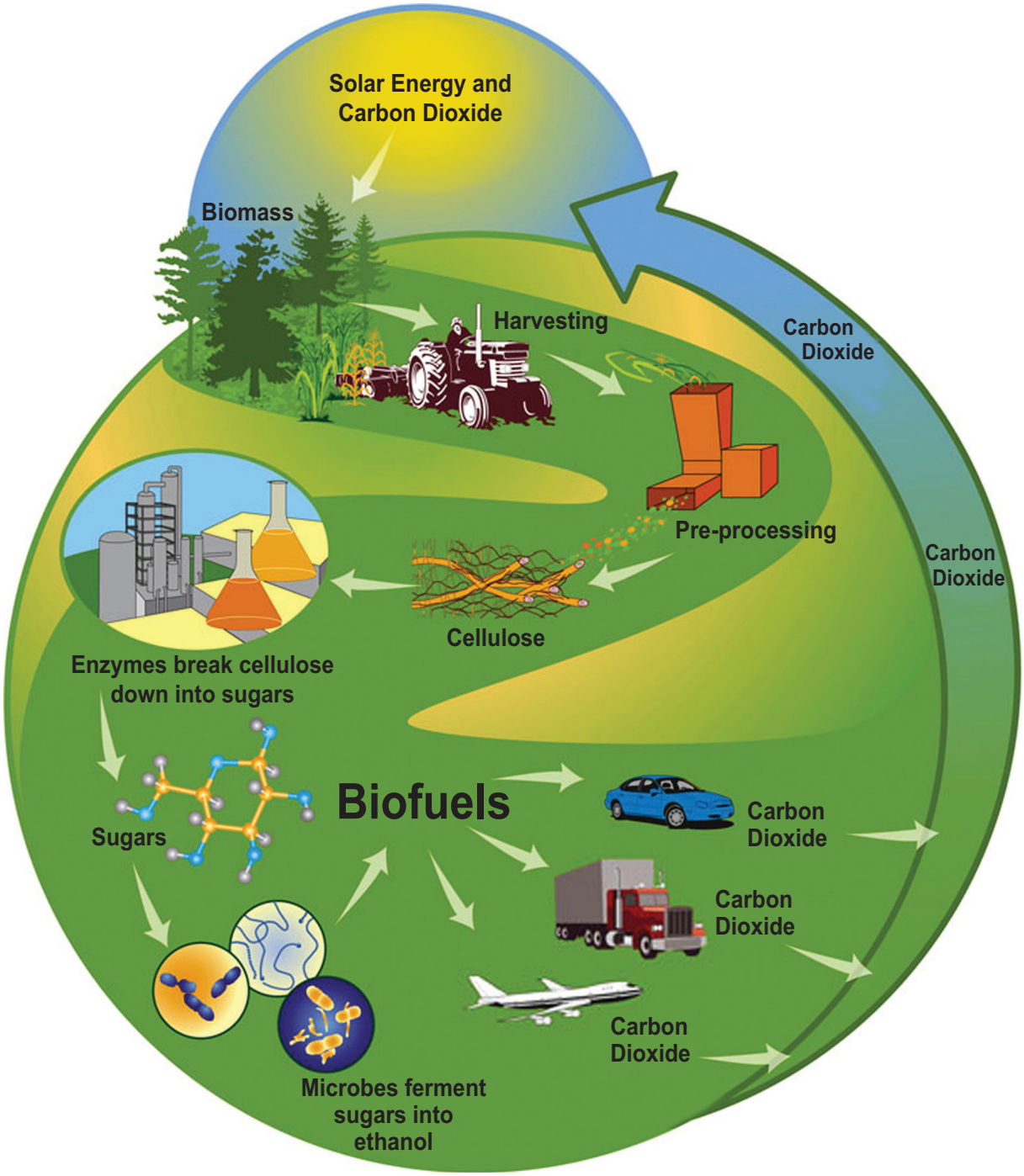
Figure 18: Percentage of electrical energy produced from alternative sources, 2012



Source: www.geocurrents.info

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Figure 19: Process of producing biofuels

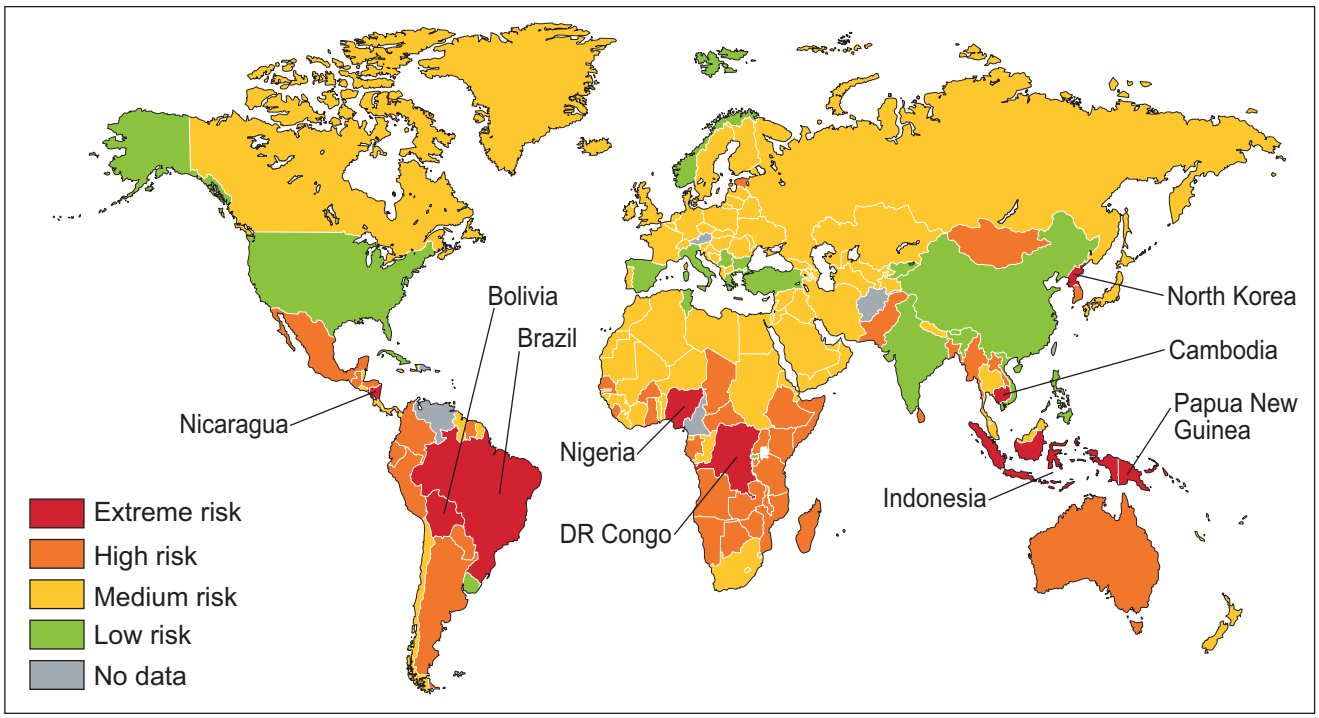


Source: whyfiles.org

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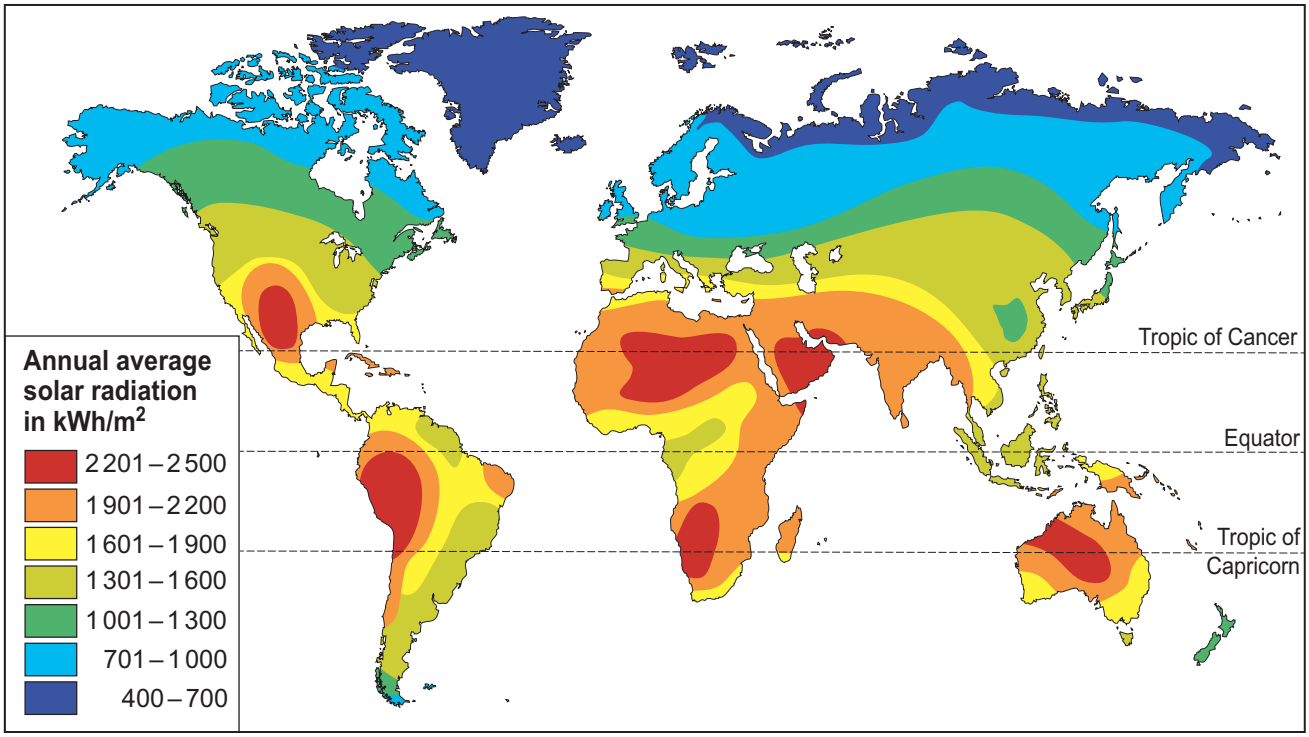
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Figure 20: Areas where biofuel production increased the risk of deforestation in 2012



Source: maplecroft.com

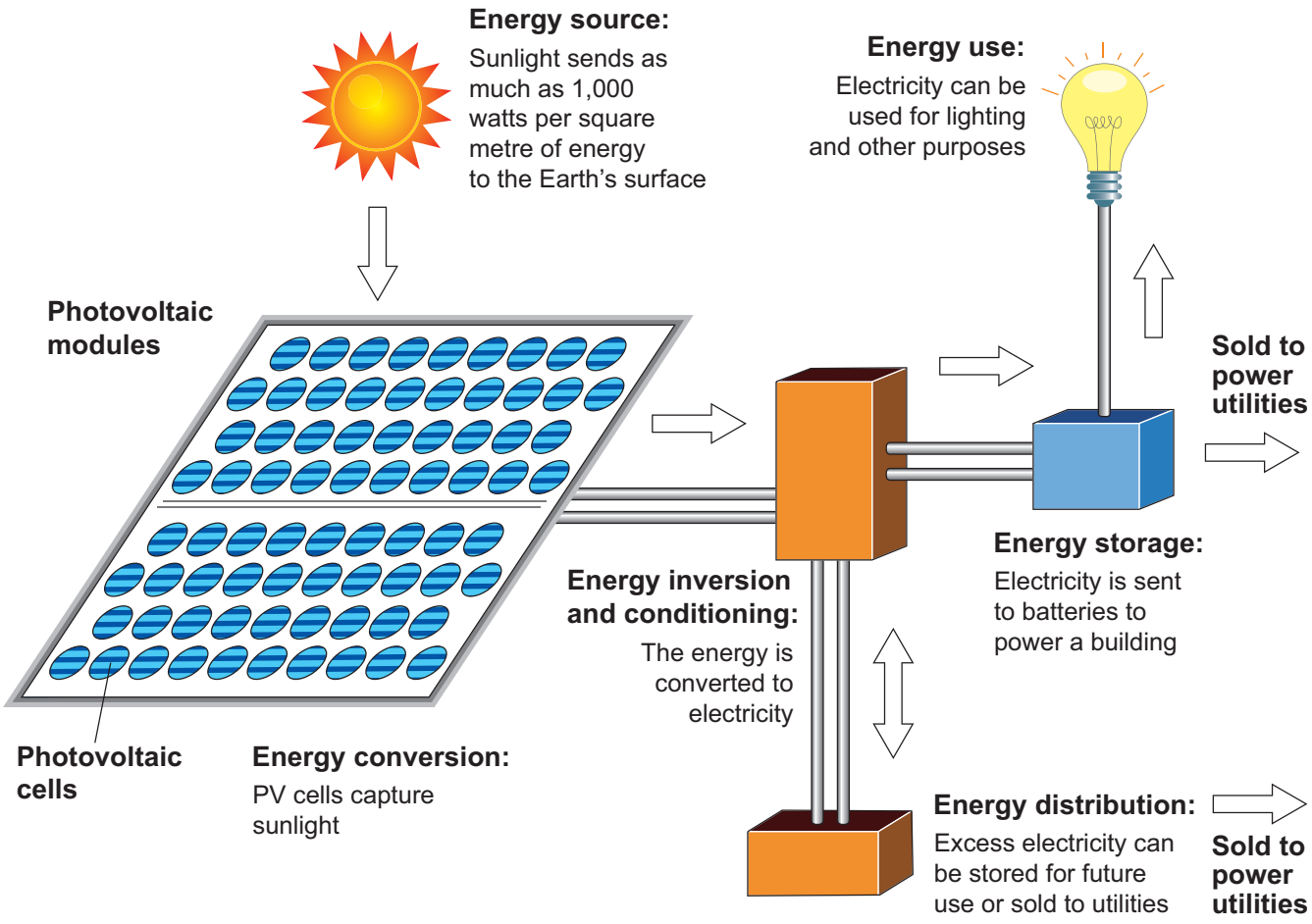
Figure 21: World solar energy potential



Source: micro-hydro-power.com

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Figure 22: Production of solar photovoltaic (PV) energy



Source: adapted from solarenergyprosandcons.com

Figure 23: Costs of generating energy from different sources

Source	Cost per MWh (US$)	CO2 per MWh (kg)
Coal	85.6	888
Oil	90.8	735
Natural gas	66.3	500
Nuclear	96.1	28
Biomass	102.6	45
Wind	80.3	26
Solar photovoltaic	130.0	85
Hydroelectric	84.5	26

1 tonne = 1 000 kilograms (kg)

Source: adapted from www.eon-uk.com
www.eia.gov
www.world-nuclear.org

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Figures 1-3	http://iph-partnership.org/index.php?title=Urbanisation_and_the_future_of_PHC
Figure 4	http://www.demographia.com/db-intlcityloss.htm
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Figure 7	http://books.mongabay.com/population_estimates/full/Budapest-Hungary.html
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Figures 9-11	http://www.earthgauge.net/wp-content/CF_Weather_and_Energy.pdf
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